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EDITORIAL

Contour Fencing

THE paper by Doctor Buie, beginning on the page opposite, and its discussion by other authors confirm a conviction which has been gradually growing in mind; namely, that in its permanent and solvent form the conservation of soil and water is simply a way of farming. Corollary to that conviction is a belief that, in all humid areas and some semi-arid regions, the common denominator in conservation farming is the contour.

For convenience in culture and for crop rotations which are both rational and feasible, fields should cease to be rectilinear divisions of the farm looked at in plan; rather they should be sliced from its profile. Fences, like furrows, should run on the level regardless of lateral curvature. But, as contour culture threatens to sound the death knell of that nuisance, the planter wire, so does it present a challenge to fence wire.

Recalling the aphorism (though not the author) that "the difficult can be done now; the impossible takes longer" we suggest that it is none too soon to start the development of fences not premised on straight lines and severe tension. We suspect that some research into the stability of soils and subsoils, plus some mathematical analysis, may point the way to line posts with much higher transverse holding ability than those now used. With fencing of more moderate tension, and with variable spacing to limit the angle of deviation at any post, they may well make possible curved fences for contour farming.

Even with good engineering such fences are likely to be rather costly, both per rod and particularly per acre because of the greater length and curved outline of fields. However, if such permanent main fences be supplemented by portable electric fences it is conceivable that the total fencing for the farm can be kept within reasonable cost, and at the same time gain some advantages in flexibility of rotations and convenience in cultural operations.

In any event, replacement of fences will be an important phase of postwar rehabilitation. There will be both opportunity and occasion for comprehensive relocation of fences and revision of field boundaries. We shall be remiss unless we are ready with fencing, posts and procedures to put these structures on a par with the buildings and machinery of the new agriculture.

Which Way to Terrace

BARELY mentioned but still obvious throughout all the discussion by Doctor Buie et al, whenever the matter of terracing with ordinary farm implements was mentioned, is the question as to the relative merit of these methods compared with those employing large units of power and special terracing machinery. Just now it may be a moot question, but with lifting of war limitations it may become a live issue.

We hope that it will not become a matter of controversy, but of competition. If the protagonists of the two methods both do a constructive selling job it will get more terracing done than for either method to become complacently supreme. Nothing brings a practice or a product so swiftly into general acceptance as for all parties to take for granted its desirability and proceed to push their respective machines or methods.

With the coming of peace we may look for release of considerable numbers of contractor-type tractors and earth-moving machines, and the return of considerable personnel skilled in their operation. It would be in the interest both of agriculture and of general postwar adjustment to find immediate employment for these men and machines in building terraces and other conservation structures such as farm ponds. It will obviously be better for them to be privately employed by farmers than to foist them on farmers at public expense.

All the terracing that is likely to be done in the interim, by use of farm tractors and plows or with such special equipment as is available, will be but the proverbial drop in a bucket. Its effect will be mainly to whet the appetites of farmers for faster and perhaps more economic ways of getting terraces built. If, as we have reason to hope, both types of terracing are done side by side for a period of years it should result in gradual survival of whichever is the sounder, not only economically but technically and psychologically.

The last point deserves some emphasis. As we have mentioned before, the performance of terracing with ordinary farm power and implements has the effect of making it merely farming, and as such more likely to be an accepted part of farm thinking and planning. Another psychological phase of homemade terraces is that of maintenance. A man who has made his own terraces the hard way is less likely to let them degenerate than one whose terraces were, so to speak, dropped suddenly from the sky.

Bring in the Bankers

NO FISCAL agency in all the American scene has been able to make so constructive a contribution to the advancement of agriculture as the local banker in those cases where he is imbued with ambition to build up his community, has ingenuity to hurdle the obstacles inherent in a banking structure cut to the measure of commercial concepts, and is guided by a vision of what it takes for a permanent, productive agriculture.

We would be statisticians rather than engineers to dwell too much on the circumstance that such cases have been too much the exception and too little the rule. There have been enough brilliant examples to demonstrate the possibility and the desirability of that kind of banking leadership in rural communities. Just as we continue to scourge the railroads for the sins of the Jay Gould era, so do we err if we continue to talk in terms of glass eyes, note shaving and premeditated foreclosure.

Many are the expedients, public and private, to circumvent the limitations of bankers and banking regulations. We have loan sharks, finance companies, mortgage banks, intermediate credit agencies, and subterfuges to subsidize inherently insolvent attempts at farming. Their results range from exorbitant exploitation of victims for private gain to looting of the public treasury. Between these extremes are measures and agencies which have done much good.

Appraising them all, broadly over the years, suggests that no system of big business, public or private, applied by remote control is likely to be so soundly helpful as the individual crossroads banker left free to use his own capital, his own discretion, and his own vision. No system can take the place of his personal interest, his personal information, and his personal influence. *(Continued on page 95)*

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The Machinery Factor in Soil Conservation

By T. S. Buie

IF American agriculture is to produce efficiently now and in the future, production must proceed without waste. For one thing, every acre of productive soil must be made to yield its fullest, yet without endangering future production. This can be accomplished by using the land according to its capabilities, under a sound system of conservation farming. This is not only practicable but profitable, as throughout the nation conservation farming has increased per acre yields and total production on the farm as well. The soil, our basic resource, need not be expended now, nor in the future if we use it wisely.

By placing the row crops on the more favorable slopes instead of on steep land, in keeping with the principle of good land use, labor-saving equipment can be used more efficiently. Many times two-row equipment is rejected on a farm because it cannot be used on steep and eroded places in a few fields. Furthermore, shorter rotations may be used on the gentle and moderate slopes, making it possible to devote the steep slopes to hay and forage crops. Steep slopes are better suited for the use of haying equipment than for riding cultivators.

Most agricultural engineers, I feel, have a good conception of the soundness of modern conservation farming and are generally agreed that it cannot be attained through the use of a single or few conservation measures. The conservation plan must be complete and especially fitted to the individual farm. Effective barriers must be provided against every actual and potential soil-wasting danger. Sometimes this may involve the use of a combination of conservation practices on a single field to insure maximum protection. On rolling crop land, for example, it may be necessary to support the terrace system with strip cropping so that the terraces will not be too severely taxed during heavy rains. Land that is too steep for row crops may be suited to hay or other permanent cover, or trees. Each field on the farm must be carefully studied to insure good land use.

In short, conservation farming is aimed at the wisest and best possible use of soil and water resources so that each acre will produce the maximum amount of the crop it is best suited to produce. To achieve this it is necessary to use a variety of agronomic and engineering measures, as a single or few measures will not suffice.

Indicative of the widespread interest among farmers in conservation farming are the 948 soil conservation districts, embracing 544,345,000 acres, that have been organized in the United States. Since 1937, forty-five of the forty-eight states have passed state soil conservation district laws, or enabling acts, which authorize farmers to organize these local governmental units for conserving soil and water if they so desire. In the nine states south and east of the Potomac, Ohio, and Mississippi Rivers, which form the southeastern region of the USDA Soil Conservation Service, there are 189 districts, covering 150,383,000 acres, or more than half the land area in the region. Practically all of these districts have enlisted the help of the SCS in developing conservation plans for individual farms.

Inasmuch as my experience has been almost exclusively in the Southeast, my discussion of the importance of machinery in soil conservation will be confined mainly to this region. This is probably not out of place as it is well recognized that in the Southeast we have a large variety of erosion-control problems.

Also, we assist a number of soil conservation districts in their drainage projects as there are many areas in the Southeast where agricultural production can be substantially increased through drainage. Through the use of subsurface drainage, open ditches may be filled up, thereby increasing the size of fields which results in increased efficiency of crop production machinery. Where it is necessary to use open-ditch drainage, the ditches may be constructed with such cross section that they may be easily crossed with machinery.

From the beginning of the soil conservation program in the Southeast one of the serious handicaps has been a shortage of modern farm machinery. In the erosion-control demonstration projects that were first set up it was not unusual to find a scarcity, if not an entire absence, of such common farm implements as mowers, hay rakes, grain drills, and so on. The machinery the farmer did own was largely that needed in planting and cultivating such crops as cotton, corn, and tobacco. The lack of other equipment naturally handicapped him in switching to a more diversified type of farming in which grasses, legumes, and small grain figure conspicuously.

We observed, however, that most farmers who established hay and forage crops as called for in their conservation plans managed to harvest the crops. Many bought mowers and rakes while others who were unable to do so borrowed such machinery from their neighbors. On many small farms the scythe was used to cut hay so that it would not go to waste. Seed of larger plants such as crotalaria was in many instances harvested by hand.

Obviously, conservation farming as now practiced calls for the use of a large variety of farm machinery including terracing equipment, harrows, soil packers, seeders, grain drills, mowing machines, rakes, combines, hay balers, lime spreaders, seed cleaners, and other equipment. Thus it can be seen that many pieces of farm machinery have a direct relation to soil conservation, although they may have been built primarily for tilling the soil, planting, or harvesting crops. The combine, for example, is used to harvest seed. Yet we regard it as a soil conservation tool as it has a direct relation to that phase of the soil conservation program in the Southeast which is aimed at greater use of legumes and small grain in crop rotations and more forage on

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the farm. Without the combine, less seed would be harvested, which in turn would mean less seed for establishing better crop rotations, pasture, and hay.

Ordinarily, we look upon the mower as the machine that cuts grasses and legumes for hay. However, like the combine it has become an important conservation tool in the Southeast. Not only are more mowers needed to harvest the larger acreage of hay, but as a result of the emphasis farmer-operated soil conservation districts have placed on pasture improvement, the mowing machine is being used more and more to clip obnoxious weeds in pastures before they go to seed. This gives the desirable plants a better chance to grow. Distinct soil conservation uses have been found for other pieces of farm machinery in the Southeast, and I am certain the same is true in other regions of the country.

As soil conservationists, we are also interested in farm machinery which may at first appear to be entirely unrelated, or at least remotely related, to soil conservation. If the machine saves the farmer time, labor, and expense then we as soil conservationists are vitally interested because labor-saving machinery enables the farmer to equalize his farm work and in turn do a much better job of conservation farming. In the Southeast, for example, cotton is a field crop that still requires considerable labor. In fact, on many farms cotton requires so much labor at certain times of the year that the farmer finds it difficult to engage in a more diversified type of farming. If, on the other hand, labor requirements for this particular crop could be measurably reduced through the use of power machinery and improved or new farming tools, the farmer would be in a much better position to grow other crops, including forage and feed for livestock. No doubt after the war improved machinery that saves time and labor in growing and harvesting the cotton crop will be available.

Since there is a distinct need in the Southeast for modern farm machinery, does it appear likely that farmers in that region will buy more machinery after the war when it becomes available? Inasmuch as I am not an economist nor sales expert, I would not venture a direct answer, but there are several factors that indicate more machinery will be purchased. For one thing many of our young men in the Southeast, both white and Negro, upon returning from the war will never be content to farm behind a mule and a plow after having driven jeeps, airplanes, trucks, tanks, and other mechanized war equipment. It will certainly be difficult to keep these young men interested in the farm unless they can use power machinery to do the work. Or, if they acquire farms or assume active management of their fathers' farms, it is almost certain they will make every attempt to equip the farm with modern machinery.

One of the reasons many farmers in the Southeast have clung to old methods of farming is that up until the war they usually had sufficient labor available. If the main crop was cotton, it was not much trouble to keep a large number of workers busy. The war, however, has changed this picture and farmers in the Southeast as well as those in other farming regions have had to resort to labor-saving methods. I recall one farmer who had a tractor, but before the war used it mainly in plowing the land for cotton and in orchard work. When it came to cultivating cotton, Negroes did that work with plows and mules. Last summer when I visited this farm the farmer had lost a large part of his help and one of the remaining Negroes was cultivating the cotton with a tractor.

The farmer's son, who had assumed active management of the farm since his father was rather elderly, informed me that the tractor and cultivating equipment did just as good a job of cultivating the cotton, if not better, than a Negro behind a plow and a mule.

Should there be a demand upon agriculture to absorb a large number of the workers returning from war, I do not believe that farmers as a whole will resort to outmoded methods just to furnish work for the surplus labor. The war has focused farmer attention on the part machinery can play in increasing production, and most farmers, I dare say, will wish to make the most efficient use of labor that can be made. If the labor surplus problem should become acute, worthwhile projects could be planned and undertaken that would be of definite benefit to agriculture. In the Southeast, for example, there are still thousands of acres of idle land that could be put back into safe and profitable production, and many acres of land that would benefit greatly from drainage. In either case, machinery would be required to do this kind of work efficiently.

Conservation farming as practiced by farmers cooperating with soil conservation districts is setting the pattern for a better and permanent agriculture in the Southeast. Already some 60,000 farmers whose farms embrace nearly 10 million acres are following well-rounded conservation programs that the districts developed for their farms. Most of these farmers no longer depend entirely on cotton, tobacco, or other row crops. This trend toward a better balanced farming is revealed in a survey that was made late last year of 1,829 widely scattered southeastern farms. The cotton acreage, for example, was reduced on these farms from 49,590 to 40,155 acres as called for in the conservation plans to insure good land use. The average yield per acre, however, increased from 294.5 to 385.1 lb of lint cotton, and total production from 29,207 to 30,926 bales. Likewise, more corn was grown on fewer acres through better land use and conservation methods. The acreage was reduced from 70,357 to 56,527 acres, but the per acre yield increased from 17.7 to 25.2 bu and total production from 1,246,461 to 1,424,481 bu.

As a result of pasture improvement work and establishment of hay and other feed sources, the farmers covered in the survey were able to raise more livestock and poultry on their farms. The number of cattle increased from 25,557 to 46,549, or 82 per cent; hogs from 25,326 to 40,890, or 62 per cent, and poultry from 158,518 to 253,523 or 60 per cent.

Agricultural engineers, I am certain, are vitally interested in this type of farming. By their training and experience, they are also in a favorable position to contribute most effectively to the advancement of conservation farming. The supervisors of soil conservation districts, for example, will welcome any help they may obtain from agricultural engineers, and especially that kind of help which will clearly demonstrate to farmers the many uses to which our modern farm machinery can be put. Since many farmers will be using power machinery for the first time, especially in the Southeast, I feel it is incumbent upon us all to keep abreast of developments so that we, too, can help the farmer make the best possible use of the machinery he may have bought.

The Soil Conservation Service, I might add, welcomes opportunities which enable its workers and representatives of industry to study mutual problems and exchange information. During the past year we conducted several field trips in the Southeast in which representatives of farm machinery and fertilizer manufacturers and agricultural agents of railroads participated. I feel certain these men gained a better understanding of conservation farming and its importance to agriculture in the Southeast. Needless to say, we in

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the Soil Conservation Service profited from the information given us by the representatives of these industries. One farm machinery company, after its group had made a field trip, arranged a comprehensive field demonstration of its machinery suited to southeastern agriculture so that we might gain a better idea of how it could be used in conservation farming, especially in the postwar period. Each piece of machinery on display was operated under a variety of field conditions to demonstrate its practicability.

If we attempt to envision some of the opportunities that lie ahead for American agriculture, we inevitably come up against the salient fact that no longer can we acquire new land for farming purposes. Our agricultural frontiers are gone. I think, however, that we are rediscovering our land. We are learning how to make the land produce more without endangering or wasting its productive capacity. Moreover, we have come to appreciate better a fundamental principle of sound farming, namely, that *our land does best when used for the purpose for which it is best adapted.*

The new pattern that conservation farming is weaving on the American landscape typifies this new, wholesome respect for the land. If we can develop this respect further and at the same time see to it that more and more farms embrace this newer system of farming, then we will be well on the way toward a permanent, healthy American agriculture. I am sure that the members of the American Society of Agricultural Engineers are as much interested in this as are the technical workers of the Soil Conservation Service and the supervisors of the soil conservation districts.

Discussion by Frank Kranick

FELLOW A.S.A.E.

IN THE sense of national sufficiency, the significant thing about all this work in soil and water conservation is that it is both enlarging our production areas and increasing the production per acre within those areas. As it affects the individual farmer, and in the aggregate the whole agricultural population, the significant thing is that we are finding ways whereby we can pursue conservation methods in farming which yield greater production per person employed and bring in greater earnings per farmer. In the long-range look, it is significant that these methods protect both the national food supply for posterity and the value of the property which the individual farmer can bequeath to his children and grandchildren.

Through all the complex fabric of methods and objectives, present and future, there runs one continuous, consistent thread. The measure of success is the degree of mechanization, the amount by which the work of each man is multiplied by power and machinery. This great principle is not refuted but rather is emphasized by the fact that when the multiplying power of machinery is used for short-sighted or misguided methods it may hasten the depletion of soils and the destruction of land values.

Without attempting to unravel the interwoven warp and woof of cause and effect, we will do well to bear in mind the broad, basic fact that the best single index to the farm standard of living is the degree of mechanization. Whether we use more machinery to permit better methods, or use better methods to permit the purchase of more machinery, the results are the same. Farmers have more money, farm homes have more comforts, farm children have more education. This is true alike in regions of light or heavy rainfall, warm or cool climate, rich or poor soil.

I dwell on these facts because they are the background for the part which the farm machinery industry has begun to play, and will increasingly play, in the conservation of soil and water by practical, solvent systems of farming. It may sound crassly commercial, but the biggest boost the manufacturer can give to soil conservation is to do a bigger and better job of selling *the use* of his machinery in the methods which the scientists are discovering and the extension engineers are teaching.

Mr. Zirckel, Dr. Buie, and the other men who have preceded me in this discussion have pretty well covered the technical aspects of the use of various machines both in the building of soil-saving structures and in pursuing crop production methods which embody soil-conservation principles. They have brought out the cooperation of machinery manufacturers with conservation specialists in working out concrete procedures. I will not go over that ground again, but I would like to state my belief in the soundness of the methods mentioned more particularly by Dr. Buie; namely, the use by farmers themselves of their own regular farm power and implements for terracing and other soil-saving measures.

The manufacturers have rendered a very substantial service by encouraging and educating farmers to put these methods into practice. In the industry it is called publicity, but in effect it is supplementary education, adding all the prestige and push of the industry to what the research and extension forces are doing. Page after page of paid advertising has been devoted to promotion of soil-saving, fertility-building practices. Manufacturers have cooperated with farm paper editors by supplying freely the data and the pictures which have been woven into feature articles and editorial comment.

Special mention should be made of the movie films, many of them in full color, which sundry manufacturers have prepared to stimulate interest and understanding in soil conservation practices. Some of them have been shown to you at meetings of the Society. You may remember such titles as "For a Permanent Agriculture," "Soil Builders," "Hold that Farm," "Roots in the Ground," "Building Back," "Win Against Water," and "Soil and Life"—to mention only a few that come to mind.

All of these films as well as bulletins, charts, and other educational matter created by the industry have been made freely available to the colleges, extension men, schools and institutes, as well as being shown or distributed by the manufacturers themselves and their dealers. Some companies have gone so far as to conduct their own field demonstration projects to exemplify conservation practices. I have no data to show the total expenditures by the industry in this cause, but I do know that one company alone for a full decade has been devoting about $30,000 a year in various measures to encourage acceptance of soil-saving methods by farmers.

As I have just indicated, the farm machinery dealers are doing a worthy job, but I doubt whether we are giving them full recognition for it now, or arranging for the full responsibility which they can carry in the future. The way they have met the challenge of the war, changing almost overnight from a program primarily of sales to one mainly of service, with problems that called for resourcefulness of a high order, compels us to revise upward our estimate of these modest men. I believe they will play a big part in the change-over to conservation methods.

Thus far their sources of information and inspiration are mainly the manufacturers they represent, and perhaps this should continue to be so. But they also have personal acquaintance with the county agents, extension men, etc., and I believe these contacts should be encouraged and extended. Certainly, in the re-equipment of agriculture which is destined to follow the depletion of war, we should be sure that dealers have the vision to give far-sighted guidance in the choice of machinery best suited to still more efficient application of conservation principles.

Discussion by C. H. Zirckel

MEMBER A.S.A.E.

FOR many years those of us in the farm equipment industry have been inclined to think of terraces when we thought of soil and water conservation. Today we are thinking of it in a broader sense, for we realize that terraces are only a part of the problem. Terracing, drainage, farm rearrangement and land utilization, strip cropping, contour farming, stubble or subsurface mulching, basin listing, livestock, row and seed crops and others—all are a part and enter into any discussion on soil and water conservation. Many of these things will be found on any one farm regardless of its geographical location.

It would serve no useful purpose to recount all the machines that have been built for terracing, ditching, etc. There have been many specialized machines, but probably the farmers as a whole have derived more benefit from newer methods which have allowed them to utilize their regular farm machines.

Perhaps the most interesting development has been made in the development of methods and procedure for the building and maintaining of terraces with standard plows (both horse and tractor), disk plows, harrow or wheatland plows, and slip scrapers. Methods may vary but probably four of the most generally used

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are the "island method", "the step-in method", the one-land and two-land methods. The island and step-in methods were well covered by L. G. Samsel in his paper published in AGRICULTURAL ENGINEERING for October, 1943. Terraces must also be maintained, and this is done with the same equipment used in building them.

The cost accountant can point out perhaps where the practice of building terraces with regular farm equipment would increase the cost since more hours of labor may be required over that of building terraces with larger equipment. However, it is the cash outlay that gives the farmer concern, and when he can use his own machinery and his own time, the cash outlay is very slight.

Terracing farm lands is a very old practice in the Southeast. Hillside ditches, bench terraces and Mangum terraces of various widths which have a tendency to become bench terraces were the rule and presented an impossible problem to the farm implement manufacturer. With the introduction of the Nichols or drainage type terrace, farm equipment manufacturers were in position to design and build suitable equipment for use on terraced slopes.

The problem of meeting the planting requirements in that area with power-farming equipment was difficult. It was necessary to go in one step from the small walking plow, one-row fertilizer distributors and planters, and small walking cultivators, some requiring two rounds or more to each row, to the tractor and tractor-drawn and operated equipment. Planting requirements were severe. Seed to be planted ranged from peppers to velvet beans, corn, peanuts and cotton, corn and velvet beans often being alternated in the same row. It was necessary to follow custom and plant some of the crops in the so-called water furrow, others on the level, and cotton in particular on a bed. With all of these crops it was necessary to apply fertilizer in bands adjacent to the seed zone and maintain the placement even around the sharp turns of the terraces. Incorrect placement might result in contact of the fertilizer with the seed causing burning and poor germination, or it might be placed so far from the seed zone as to be more or less ineffective.

MACHINERY REQUIREMENTS THAT HAVE TO BE MET

These problems were met quite satisfactorily, and even the tractor wheel marks are removed when planting to prevent crusting and baking. Several such planters are now available and for various sizes and makes of tractors.

In the western areas where fields are larger, terraces further apart, curves on a longer radius, and where fertilizer is not used so extensively, specially designed planters do not seem to be required.

Some types of tractor disk harrows have been modified in the power control mechanism so that the gangs may be taken out of angle in crossing grassed drainage channels and returned to angle after the channel has been crossed, thus saving time and avoiding injury to the channel.

It was found that pulling a wagon alongside the corn picker did not work well in terraces. Corn pickers are now available in which the corn is delivered at the rear of the picker into a wagon pulled behind. This arrangement seems preferable in operating in terraced fields and is not detrimental in fields which have not been terraced.

Farm Rearrangement. Much can be accomplished in soil and water conservation by rearrangement of fields and land utilization; thus slopes which would otherwise erode badly can be kept in permanent pasture and erosion stopped or lessened. No specialized machinery seems to be required though the electric fence is often found useful. Certainly much can be accomplished by the rearrangement of many of our farms but that can only follow better education and extension work.

Strip Cropping. Arranging crops in strips is a desirable farm practice in which again no change in farm equipment is required. It is a practice, however, that is followed more extensively in the western areas than in the central and eastern states. It was gratifying during a recent trip in the West to observe the extent to which strip cropping is being practiced.

Contour Farming. This again is a method of farm operation which apparently has not required the development of specialized equipment. Certainly much can be accomplished in soil conservation on rolling lands where it is plowed, tilled and planted on the contour. Many farmers who are now planting corn on the contour are following the practice of hill dropping the corn even though it is not in cross check. Standard planters now available are equipped, or can easily be equipped, with the device required for automatically dropping corn in hills.

New developments in soil and water conservation are followed closely by the farm equipment industry, not only from a desire to be cooperative but in its own self-interest. When the farmer prospers, the industry prospers, and only then

Stubble Mulching. This is a new practice of rather recent development designed to prepare the field for planting or fallow without turning the soil and leaving all or most of the stubble or crop residue on the surface, for the retention of moisture in the western semiarid areas and to decrease erosion in the more humid areas. Special machines are now on the market for stubble mulching and others are in development. Wide sweeps that can be used with plows, listers, uni-tillers, and tool bar frames are now available. I do not believe it can be said at present what effect this practice may have on the machinery used for succeeding operations such as drilling grain and planting feed crops, grain sorghums, corn, etc.

Whether or not changes will become necessary in such equipment in order to contend with such a volume of surface material can only be determined from further experience.

It might be well here to digress to the extent of calling attention to the situation which now exists in the so-called corn belt due to the great spread of the European corn borer. All counties in Illinois now show infestation, also the first five tiers of counties in Iowa just west of the Mississippi River. In much of this area it has been the practice to follow corn with oats, leaving most of the crop residue on the surface where it has, no doubt, served a good purpose in the retention of moisture and in reducing erosion. Such crop residue left on the surface provides perfect shelter for the corn borer, and if we continue to follow it, past experience would indicate that borer infestation can increase to such a point that it will be impossible to grow corn. This practice, therefore, must be changed — and soon.

Basining Equipment. Much has been accomplished in western semiarid areas where land is summer-fallowed by the use of basining equipment or damming attachments on listers and similar results have been secured with one-way disks by the use of special disk blades. There are also available specially developed combination machines for forming basins and fallowing, as well as planting. In those areas soil conservation is largely water conservation and the use of the lister, especially with damming attachments, following the contour, not only retains moisture but largely prevents soil blowing. The lister has been used quite successfully for contour furrowing of western range lands with a considerable increase in carrying capacity for livestock. The use of such equipment at the present time is at a rather low ebb due to a succession of years in which the rainfall has been fairly ample. Dry years will come again certainly, and implements for this type of soil and water conservation are available.

The farm implement industry follows quite closely new developments in soil and moisture conservation, not only from a desire to be cooperative but in its own self-interest. New practices and new requirements are closely followed. Practices which are good for the farmer in preserving or increasing the productivity of his land and in the return to him from the operation of his land, are good for the farm implement industry.

Dairy Cow Housing Under Study

By S. A. Witzel and G. R. Barrett

MEMBER A.S.A.E.

IN October 1940 the board of regents of the University of Wisconsin accepted a grant of funds from the Carnegie-Illinois Steel Corporation for the establishment of an industrial fellowship to "study the relative advantages and disadvantages of the open pen type of dairy barn with the conventional, insulated stall type of dairy barn." The cooperating agency also agreed to provide a complete set of experimental dairy structures to be erected on the University Hill Farms. The cooperating agency was represented by F. J. Reynolds and D. C. Wiggins, while supervision of the "Dairy Barn Research Project" as it is called, has been carried on by the authors under the joint administration of the agricultural engineering and the dairy husbandry departments of the University. Other cooperating departments include Agricultural Bacteriology, Dairy Industry and Veterinary Science. Cooperating farmers operating pen barns of their own who have contributed much to the project work are L. A. Markham of Janesville, Wis., and D. B. Ellis of Elgin, Ill. Advanced agricultural engineering students who have held the fellowship are A. M. Einerson and R. J. Kilpatrick.

The project was set up after it was acknowledged that conventional methods of housing dairy cows might be improved upon. It was further agreed that careful consideration should be given to other methods of housing dairy cows which might be adapted, developed, or improved. The more important factors to be considered included (1) comfort, health and length of animal life; (2) quantity and quality of milk produced; (3) building and equipment costs per unit of product; (4) labor requirements; (5) efficiency in the use of feed and bedding; (6) flexibility of structures to accommodate fluctuating herd size.

The foregoing represent the more important factors having a bearing on the subject of housing dairy cattle and when considered on this basis, the pen barn seemed to offer some advantages if developed in conjunction with the milking parlor. Since the insulated conventional tie stall barn seemed to represent the accepted standard, it was decided that this method of housing the dairy cow should be the control with which the open pen type run barn could be compared. It was agreed that the best way to answer the question of which housing method was better would be to let the cows give their own answer.

In line with this idea two one-story, firesafe dairy barns were designed complete with one milk house for the two barns and the necessary feed storage units (Figs. 1 and 2). The cooperator chose to use standard prefabricated steel buildings with the idea that improvements in design could be made when more of the basic requirements were better known. Two herds of 17 cows each were to be housed, one herd in a conventional tie stall barn and the other in the open pen barn. For convenience these two barns were attached to each other. Provisions were made for raising the calves in each barn. A weighing room centrally located made possible the weighing of all animals at regular intervals and the daily weighing of all concentrates, roughages, and bedding going to each barn.

The immediate objectives of this research project were to compare the run barn and stall barn. All the factors listed above were to be carefully measured or observed, and in addition there were included (1) temperature, humidity, and condensation conditions; (2) means of improving performance and cost of dairy structures; and (3) application and serviceability of steel to dairy structures.

This paper was presented at the fall meeting of the American Society of Agricultural Engineers at Chicago, Ill., December, 1943, as a contribution of the Farm Structures Division.

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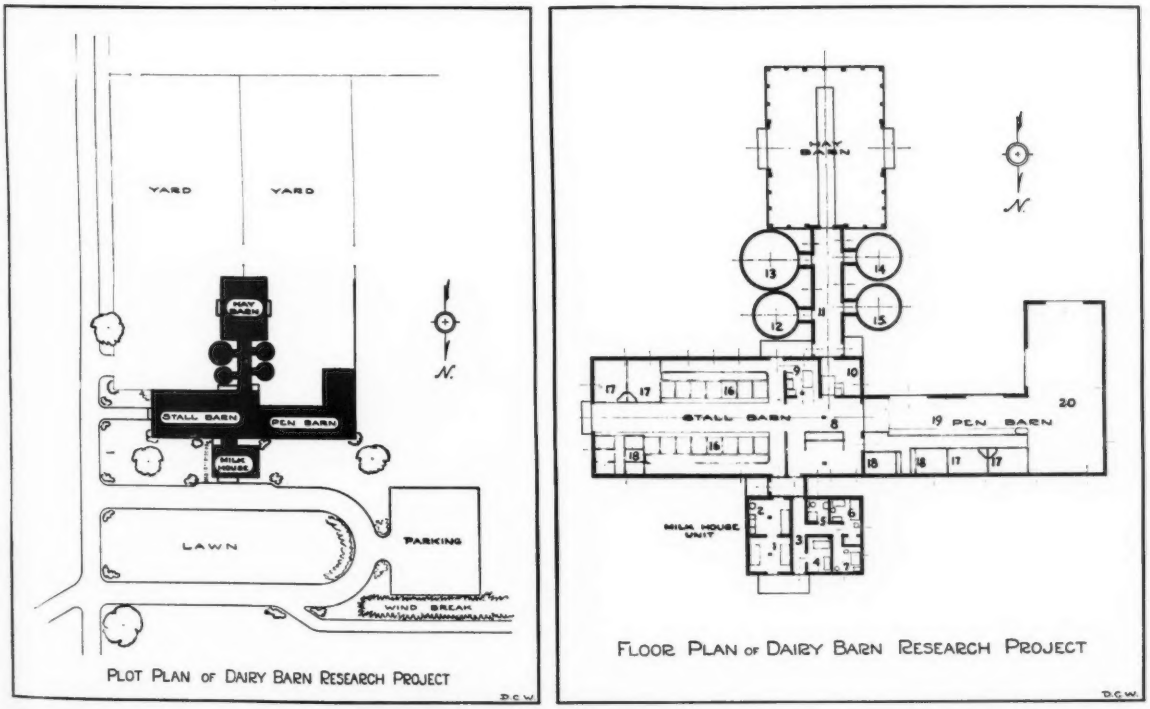

Fig. 1 Plot and floor plans of the Wisconsin dairy barn research project. The numbers in the floor plan indicate the various units in the group of structures: (1) Cooling room, (2) washing room, (3) hall, (4) furnace room, (5) wash room, (6) student room, (7) office, (8) milking room, (9) hospital room, (10) weighting room, (11) feed room, (12) grain bin, (13) chopped-hay keeper, (14) silo (corn silage), (15) silo (grass silage), (16) cow stalls, (17) cow pens, (18) calf pens, (19) feeding areas, (20) loafing area

The project is now entering its third winter. The first two winters the same herd of cows, with few exceptions, was housed in each barn, and while every effort was made in selecting the two herds we do not know how much of the difference between the two barns could be charged up to differences in the herd. This year the two herds are reversed and some interesting results are expected.

For this project the university provided a carefully selected herd of young Holstein cows and heifers that were all from a single line of breeding. The cows were divided on the basis of weight and freshening dates. Incidentally, the aim was to have most of the cows freshen in the fall and early winter although freshening continued throughout the winter months.

Fig. 2 Aerial view of the group of structures used in the dairy barn research project at the University of Wisconsin

The operation of the barn has contributed nearly one-half million pounds of milk a year to the nation's food supply. The care of the herd requires two full-time men. For the first two years the three-times-a-day milking plan was followed. This year milking is done twice a day.

Daily individual milk weights, feed and bedding weights, and health observations are kept by the regular men at the barn. Animal weights are taken twice each month. Records of temperature and humidity in each barn and outside are made by recording instruments while the outside maximum-minimum temperature readings are taken daily. Time studies, daily observation of the barn, adjustments in management and equipment have been carried out through the joint efforts of the cooperating company and the University representatives responsible for the operation of the project.

Test Periods. The complete test periods for each of the two seasons were 183 days in length and ran from October 1, 1941, to March 31, 1942, for the first season and from October 12 to April 11 for the second period. There seemed to be no particular reason why the test period should run through the summer months for the comparisons of the two barns now being made.

Temperatures. The outside mean temperature for the first test period was 40.8 F (degrees Fahrenheit) and that for the second test period 35.8 F, while 23.4 in of snow fell during the first period as compared with 52.9 in in the second period.

In the pen barn during the first test period two or three large doors were left open in all but the coldest weather creating some draughts on windy days. During the second test period in cold weather all doors except the protected one opening to the east were closed. This eliminated draughts. The pen barn temperature during the two test periods ran from 7 F to 10 F above the outside temperature.

The stall barn temperature was maintained between 45 F and 55 F the first period, but the second period this was reduced to the 40 to 50 F range, and heat from this barn was used to control the temperature in the milking room as a fuel-oil conservation measure. Heat can be provided for the milking barn by the furnace in the milk house. A thermostat on the electric fan ventilating system and opening of windows in mild weather was the means of temperature and humidity control in the stall barn. There seemed to be no adverse results caused by the adjustment to a lower temperature.

During the second test period a series of thermocouple temperature readings were made in each barn to determine the relationship between comfort conditions in the two barns. The data on temperatures is given in Table 1. It will be noted that the temperature of the manure pack in the pen barn ran up to 44 deg warmer than the top of the insulated cow stall floor. This may, in large part, account for the comfort of the animals in the cold pen barn. It also points to the fact that in a cold run barn manure must be allowed to accumulate and should not be completely removed during the cold winter period. This, in part, will probably account for the unsatisfactory results reported by Kelley and Rupel on their studies of a pen barn at Brook Hill Farms in 1931-32[1].

Temperature readings in the air around a cow, just at the surface of the hair and at the skin of the animal indicated excellent insulation of the hair coat. Radiation from the animal had no measurable effect on the air temperature only an inch away from the hair coat even when the temperature difference was approximately 100 F between body temperature and stable temperature.

Comparison of average daily production per cow in each barn with the outside temperature indicates little if any effect of temperature on production in either barn (Fig. 3). Temperature seemed to have little effect on the comfort of the animals. While it is true that they spent more of their time lying down in the colder weather, they showed no signs of discomfort at any time. In cold weather the cows in the stall barn would tend to crowd around the barn door to be let back in within a half hour after being turned out. Care was taken to protect them from exposure which might effect their health or production but daily exercise was afforded them, except in the most disagreeable weather.

Feed and Bedding Consumption. Both herds of cows were fed identical feed, hay being taken from the same supply, silage from the same silo, and concentrates from the same bin. The bedding used was also the same in each barn and has been mostly baled straw. All feeds and bedding were weighed as they were taken to each barn and the weights were recorded immediately. Table 2 is a summary of the data for each of the first two test periods.

By changes in feeding practices and in personnel, waste of feed was greatly reduced the second year. Concentrates have been fed on the basis of the number of pounds of milk produced by each

TABLE 1.

TEMPERATURE (deg F)	Dec. 12 Pen	Dec. 12 Stall	Jan. 13 Pen	Jan. 13 Stall	Jan. 20 Pen	Jan. 20 Stall
Ground level	80		84		83	
Top of concrete		60		60		58
Beneath fresh litter	95		100		70	
Top of traffic board		59		60		58
Air	30	45	31	47	17	43
Outside		25		15		8

TABLE 2.

FEED CONSUMPTION	1941-42 (Oct. 1-Mar. 31) Stall	Pen	Per cent, pen to stall	1942-43 (Oct. 12-Apr. 11) Stall	Pen	Per cent, pen to stall
Hay (lb)	71,801	85,819	119.5	72,005	72,532	100.7
Silage	70,626	72,531	102.7	74,242	77,841	104.8
Beet pulp	16,909	16,508	97.6			
Concentrates	36,189	34,790	96.1	31,929	29,095	91.1
Total digestible nutrients	103,888	109,542	105.4	72,931	71,844	98.4
BEDDING	40,373	84,896	210.	25,439	71,680	282.
PRODUCTION						
Total milk (lb)	95,400	92,437		100,931	86,204	
No. milking cow days	2,102	2,206		2,259	2,057	
Non-milking cow days	1,009	897		760	928	
Ave. milk per cow day	45.4	41.5	91.4	44.7	41.9	93.8
Ave. age of cows (April 1, 1943)				4 yr, 4 mo	4 yr, 3 mo	
BACTERIA COUNT IN MILK						
No. samples	53	50		29	24	
Bacteria count	6,738	22,420	332.8	6,690	10,500	157.0
WEIGHTS						
Total herd gain (lb)	+425	720		—189	+523	
Ave. gain cow day	+ 25	45		— 11	+ 35	
No. calf days	1,021	1,034		1,093	623	
Total gain	1,972	1,908		1,985	1,098	
Ave. gain per calf day	1.932	1.845	95.5	1,816	1,764	97.2

[1]Relation of stable environment to milk production, M. A. R. Kelley and I. W. Rupel. Technical Bulletin No. 591, USDA, November, 1937.

cow. Silage and hay have been fed in such amounts that practically all the feed was consumed. A recent improvement in the feed bunk in the pen barn may tend to reduce feed waste there.

The + 5.4 per cent difference in consumption of total digestible nutrients by the pen barn herd the first test period may be largely accounted for by waste when hay was fed in a poorly designed hay rack. The − 1.6 per cent difference for the second period would indicate a relatively small difference in feed consumption per animal in the two barns. Here again a reversal of the herds in the third test period may produce some interesting results.

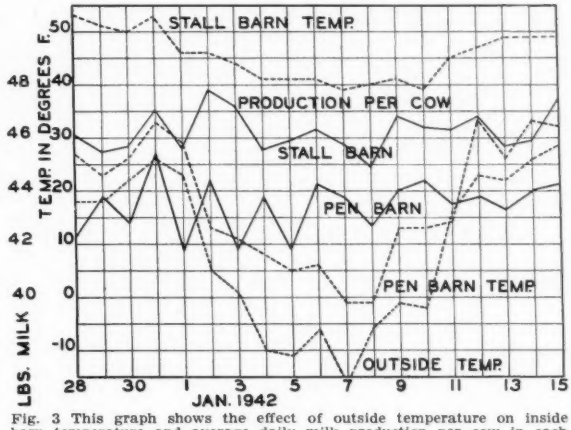

Fig. 3 This graph shows the effect of outside temperature on inside barn temperature and average daily milk production per cow in each barn through a typical cold weather period during the 1941-42 test period

A change of practice in bedding the cows in the second test period in the pen barn and more frugal use of bedding in the stall barn are largely responsible for the differences in the requirements for the two periods. In the first test period the area behind the feed bunks was bedded and it required large amounts of bedding. The manure pack was soon wet and soft after fresh straw was applied. The second period this area was paved and cleaned daily. This resulted in a reduction in the average bacteria count in the milk from 22,420 to 10,500 per Ml. While this difference in bacteria count may not be significant in itself, it was further noted that the cows could be kept cleaner after this change was made. The third test period this area is cleaned every other day and some bedding is used to control the tracking of manure into the milking parlor. In designing a pen barn the feed area is best paved and separated as much as possible from the loafing area.

Bedding is generously used in the pen barn (Fig. 4) and the cows are kept apparently as clean as in the stall barn. Under these conditions roughly from two to three times as much bedding is required in the pen barn as in the stall barn. In areas where the bedding supply is short the problem of keeping cows clean would no doubt be more serious than for cows housed in stall barns.

Daily collection and removal of droppings from bedded area has cut down bedding requirements in the Ellis pen barn. Daily cleaning of all of the Markham pen barn has resulted in high labor and bedding requirements.

Milk Production. The daily production per cow, when compared with the mean daily weather temperature, indicates no particular effect of weather on production in either barn. This is perhaps the most important finding that has been made to date.

In Table 2 the total production of milk, average milk per milking cow day, number of milking cow days, and the number of non-milking cow days are summarized for each barn. The production for the two test periods show approximately 7.4 per cent less production in the pen barn. This was partially compensated for by an average additional increase in weight of 20 lb per animal the first period and 46 lb the second period of the pen barn cows over the stall barn cows. Another factor which may or may not account for the difference is animal efficiency in turning feed into milk. This factor may show up this year with the two herds reversed and thus answer the question as to the efficiency of each herd of cows under the two systems of management.

Labor Requirements. Refinements in the buildings and equipment have improved labor efficiency in both barns. Last year the labor requirements in the two barns were nearly equal. It took 15 min longer to milk the pen barn cows and feed them their concentrates than to milk the cows in the stall barn.

In placing bedding in the pen barn twice to three times as much straw had to be handled; therefore more time was required in bedding the stall barn. Manure removal required 31 hr more per month in the stall barn. This was just twice the amount of time required for manure removal in the pen barn and was approximately equal to the additional time required for milking and bedding the pen barn herd.

Quality of Milk. High-quality milk has been produced in each barn, but so far operating techniques have not been perfected in the pen barn and milking parlor to the point where the bacteria count is as low as that obtained in the stall barn. Some adjustments in operating technique are being put into effect which may correct the difference that has existed. The milking parlor stalls were increased in width from 3 ft to 3 ft 9 in at the end of the first test period. The task of making the design and operation of a pen barn foolproof is not going to be a simple one, yet that is what dairy inspectors will want.

Bacteria counts made on samples taken from 10-gal cans of milk from each barn are summarized in Table 2.

Animal Weight and Health. The cows in the pen barn gained 45 lb each the first test period and 35 lb each the second test period, while the stall barn cows gained 25 lb each the first and lost 11 lb each the second test period. In Table 2 weight data are shown for both herds.

In January, 1943, two cows with frosted teats were noticed. This followed a severe cold spell and was not noticed until the teats began to peel. At the same time several cases of chapped and cracked teats were encountered. These occurred immediately after a portion of the warm manure pack was removed. Thus it may be dangerous to clean this barn completely during cold weather.

Swelling of hocks and knees is an affliction which prevailed in the stall barn but has not occured in the pen barn.

One cow has died in the pen barn during the test periods. The cause of death was an infected kidney and could not be attributed in any way to the animal shelter. Three other deaths have occurred in the test herd. Two were caused by foreign objects in the heart and the other by infection after a Caesarian operation.

We have encountered no evidence of discomfort that could be attributed to cold weather. Boss cows have been a problem in the Markham barn. While stanchions at the feed mangers would correct the situation, other methods of control should be tried out.

Generally speaking, the calves were raised in the same barn in which their dams were housed. Calf weights showed gains of 4.5 per cent more for the stall barn than for the pen barn the first test period and 3 per cent more for the second period. Even this difference may be largely offset because of the fact that the pen barn calves seemed to be hardier when turned out on pasture. During the first test period one calf born at − 2 F inside temperature died of pneumonia and during the second period two calves had to be removed from the pen barn *(Continued on page 89)*

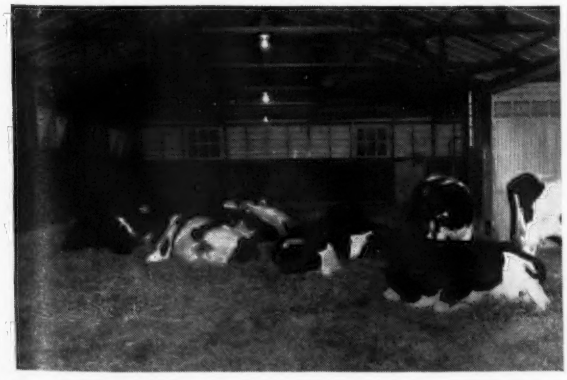

Fig. 4 A view of the "loafing" area of the pen barn used in the Wisconsin research project

Engineering Developments in Soil and Water Conservation

By T. B. Chambers

MEMBER A.S.A.E.

IN PERIODS of great emergency many of our plans and works are discarded by force of popular disapproval unless they contribute immediately to the national interest. We are in such a period now and every proposal for the expenditure of man power, equipment, or material must stand the test of economic practicability and benefit to the war effort if it survives. In the case of a soil and water conservation program this test is evaluated by the farmer himself.

The fact that the national program for soil and water conservation is in greater favor today with farmers and ranchers than at any time since its inception in 1933 is evidence that the war effort is being benefited through increased production of food and other essential crops. To support this statement let me cite briefly the development in the organization of soil conservation districts from the beginning of the first state act in 1937. By January 1, 1942, a total of 653 districts had been organized covering 382,629,000 acres of farm land in 38 states. On November 1, 1943, there had been organized 948 soil conservation districts covering 544,345,000 acres of land in 43 states. In other words, those farmers found time during the 22 months between those two dates to organize 295 new soil conservation districts while meeting the many unusual problems caused by the war. Two other states this year have each enacted a soil conservation district law enabling their farmers to participate more fully in the national program of soil and water conservation. The Soil Conservation Service is cooperating with 858 of these districts, covering over one-half billion acres of land, and the demand for technical assistance from farmers in them is far above the available resources of the Service.

Technical assistance in the fields of agronomy, forestry, range management, biology, soil science, and engineering is required to insure a sound, practical approach on each farm. Such a program will provide for proper land use, erosion control, and the maintenance of fertility. The result is assurance of sustained production for a long time to come with immediate increases in yields on most of the farms treated.

Since the summer of 1933, I have been associated with engineering work in soil and water conservation. Many developments have taken place during this time, principally in the field of crystallizing ideas and simplifying practices to an economically sound basis. Since the engineer in this work deals largely with individual farmers and groups of farmers who must bear the major portion of the cost of installing the practices, the recommendations must be technically sound, adaptable to the situation, and economically feasible in all cases. I sometimes think there is no better place for the young engineer to learn how to adjust his ideas to practical usage than in this work. Certainly the engineer engaged in the field of public works is not held to such strict accountability by a somewhat distant public as is the engineer directly engaged with a farmer's problem. The engineer's job is not simplified in many situations where erosion has impoverished the land and lowered the economic status of the operator. More work is required to conserve soil and moisture and the farmer has less means at his disposal to carry out the job. Improvising is often the only course left open for the engineer and it is from experience in solving such problems that much of the development has taken place, particularly in using vegetation as a material of construction for simple structures.

Briefly stated, the job of the engineer engaged in soil and water conservation work is "water management", a term that covers the efficient utilization of water for crop production and the safe disposal of surplus runoff. In the humid sections of the country a water-disposal system is one of the basic requirements for a farm conservation plan. The water-disposal system on uplands will consist of terraces or diversion ditches to intercept and divert surface flow from crop lands with protected outlets and waterways to conduct this water safely to a stabilized stream or protected area. On low lying lands a drainage system may be required for water disposal. In the soil conservation districts water-disposal systems for 178,645 farms have been planned. Under these plans 2,100,000 acres have been terraced and 225,000 acres have received benefits from drainage installations.

In speaking of water disposal under humid conditions it must be understood that water conservation and use are equally important for two reasons: first, to provide additional moisture for crop use and, second, to reduce as far as practical the amount of runoff to be carried through the disposal system. Practices to increase the water retained by the soil, such as contour cultivation, crop rotations, the use of crop residue for mulches, strip cropping, cover crops, and pasture treatment by furrowing or ridging are all used under applicable conditions. Stock water tanks and ponds and fish ponds are appropriate places for storing and using some of the surface runoff. The engineers of the Soil Conservation Service have designed and assisted in the construction of 19,800 ponds holding 90,000 acre-feet of water. There is also the possibility of using stored water for supplemental irrigation of specialty crops in many of the humid areas although this practice has not yet come into extensive use.

Contour cultivation and strip cropping hold much of the water where it falls. Terraces and outlets insure safe disposal of surplus runoff on these farms in South Carolina

Recently on the Shelby County Penal Farm near Memphis, Tenn., I saw a water-disposal system for 4,600 acres of pasture and crop land, one of the principal features of which was a storage system consisting of 9 ponds fed by a diversion ditch that collected the runoff from 550 acres of pasture. This system supplies water for supplemental irrigation of 100 acres of vegetables. The yield from these 100 acres has proven sufficient for the needs of about 800 people and in addition a considerable surplus is sold on the market in Memphis for an average of 10 months of the year.

The engineer's responsibility is not completely discharged with the installation of the practices. He has a further responsibility

Paper presented at the fall meeting of the American Society of Agricultural Engineers at Chicago, Ill., December, 1943. A contribution of the Power and Machinery and Soil and Water Conservation Divisions.

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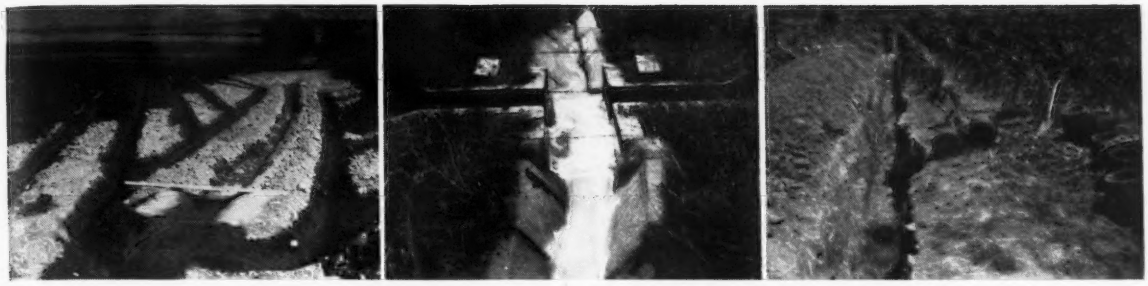

(Left) Equalizing ditches are effective in securing equal distribution of irrigation water • (Center) This concrete division box facilitates the distribution of the required amount of water to the fields • (Right) Inadequate construction and maintenance often make it necessary to relay tile drain

in assisting the farmer to make the best use of them and to carry out the required maintenance operations. Most farmers who have always farmed straight rows are at a complete loss in fitting to the field and terraces a system of contour rows. The farmer must have practical assistance in row layout and quite frequently in the operation and adjustment of implements for this new method of farming. The successful engineer in a soil and water conservation program must be able to provide this help by actually operating the farmer's equipment to demonstrate the principles he is advocating. In soil conservation districts a series of seasonal group demonstrations are carried out each year for this purpose as well as to show how to construct and maintain terraces with various farm implements.

In the arid and semi-arid sections of the country the emphasis is on conservation and use of the scant water supply rather than disposal of excess runoff. On dry farmed areas terraces are constructed level from end to end in order to hold back as much as possible of the infrequent runoff and make it available for crop production. Concentrated runoff is diverted and spread over gently sloping areas to promote increased forage on range or pasture lands; stock ponds are constructed in favorable locations, and wells are developed for livestock water and other uses. Many of the supporting practices, such as contour cultivation, strip cropping, pasture furrowing and subsoiling are used for the purpose of holding more water where it falls. On irrigated lands there is a broad field of service for agricultural engineers in the improvement and rehabilitation of small irrigation systems and in the improved use of irrigation water.

This brief outline only mentions the basic jobs of the engineer in a soil and water conservation program. There are, of course, other jobs of importance on which the engineers have a responsibility and have already made a contribution, such as stream bank protection, roadside erosion control, and localized flood control projects for protecting valuable property. Engineers of the Soil Conservation Service have cooperated with Army engineers in preparing water disposal plans for 185 Army cantonments, forts, air bases, and other Army units. Also an important feature of the engineer's job that I have not mentioned is the planning of a system of farm roads to harmonize with every farm conservation plan. The farmer must have ready access to all parts of the farm over a well planned system of farm roads to facilitate farming operations and prevent damage to conservation structures, such as terraces and outlets.

With this background on the engineer's job we may examine the record to substantiate some of the statements made concerning the value of conservation work to the farmers and the war effort. It should be emphasized that the benefits from a conservation program are due to all the practices and measures applied and the segment of benefits accruing from engineering work cannot always be separated from the total.

A cooperative study was made by the Iowa Agricultural Experiment Station and the Soil Conservation Service in 1942 to compare the yields on 30 fields of corn and 30 fields of soybeans by sampling adjacent contoured and up-and-down hill acres in each field. The average increase of yield for all fields was 6.2 bu of corn and 3.2 bu of soybeans per acre in favor of contouring.

In 1938 the Soil Conservation Service made a study of wheat yields on contoured and terraced fields in comparison with the yields from non-contoured and unterraced fields in the southern Great Plains. From 9 unterraced fields comprising 1,206 acres the yield was 11½ bu per acre. From 16 terraced and contoured fields covering 2,607 acres the yield was 15.1 bu per acre, a difference in favor of conservation treatment of 3.6 bu per acre.

It should be added that contoured tillage and terracing go well together. Contour tillage without terracing is an effective means of checking runoff and controlling erosion only on the gentle slopes and under favorable rainfall conditions. Where there is any prospect of considerable runoff, the contoured rows should be buttressed by terraces for adequate soil protection. Contouring on the other hand is one of the least expensive and most effective methods of maintaining terraces in good working conditions. Performing all tillage operations parallel with terraces results in minimum damage to the terrace ridge and helps to keep them built up to the proper height.

Reports from 450 farmers in Georgia show that yields from conservation farming were substantially greater than yields without conservation. The following increases per acre were reported: Cotton, 69 lb (26 per cent); corn, 7 bu (46 per cent); oats, 4 bu (15 per cent); peanuts, 106 lb (13 per cent); tobacco, 82 lb (9 per cent).

In a study made of terraced and unterraced bean farms in the Estancia Valley of New Mexico during the last eight years, the Soil Conservation Service has definite proof that conservation farming increases bean yields. On 143 different fields of beans grown on a total of 10,770 acres, the average yield per acre on terraced land was 328 lb. On unterraced land, 357 fields with a total of 34,709 acres, yielded an average of 246 lb per acre. For an 8-year average the terraced fields yielded 82 lb more per acre than the unterraced fields. Incomplete reports for the 1943 crop indicate 99 lb increase per acre.

Following the examples just cited of increased yield from conservation practices, it may reasonably be asked how much more does it cost the farmer in terms of increased power or time consumed in farming operations. In a recent survey made by the Northeastern Region of the Soil Conservation Service, W. H. Gemmell, Homer City, Pa., estimates that tractor power needed for farm operations has been reduced nearly 50 per cent by operating on the contour. A. A. Ditz, Fryburg, Pa., says it takes one-third less horsepower to farm on the contour. Earl J. Haifleigh, Johnsville, Md., says "Since my farm has been strip cropped and terraced, I find that my tractor operates on 20 per cent less fuel per day and our conservation plan saves between one-fourth and one-third of the time spent under our old system of farming in seedbed preparation, seeding, and harvesting."

At Kansas State College for all operations on wheat land on a 7 per cent slope, time per acre aside from turning was reduced 12 per cent, and fuel consumption 9 per cent in contoured operations.

Ten per cent less time and 17 per cent less tractor fuel was used to produce an acre of corn on the contour than was required on non-contoured fields in eastern Nebraska. This means a saving of 7 hr of time and 15 gal of fuel for the average-size field of 30 acres.

The drainage of wet land offers one means of securing widespread and immediate benefits through increasing crop production. It is estimated that there are some 31,000,000 acres of lands cultivated or partially cultivated in need of improvement of group

drainage facilities to secure maximum production. Some 80 per cent of this land has been drained in the past but many of the drainage ditches were not maintained for various reasons and as a result there are large areas of water-logged lands producing partial or poor crops. Farmers are clamoring for assistance, and in many cases technical help, equipment, and in some instances financial aid, is needed to rehabilitate drainage systems and put land in its most productive state.

One of the most recent developments of significance was a plan worked out between the Soil Conservation Service and other agencies to enable drainage work to proceed in Richland County and other North Dakota counties in the Red River Valley where an emergency situation exists. In Richland County it was estimated that there were over 200,000 acres of good land that produced no crop this year due to poor drainage. There are five other counties affected in the Red River Valley on the North Dakota side of the river and there is a similar problem across the river on the Minnesota side. Everyone familiar with the area knows the high quality of the land involved.

Recognizing the value of such work in increasing the production of food and other war crops, the Soil Conservation Service inaugurated during the year an intensive program of improving small drainage systems. A recent report indicated that about 127 of these jobs, expected to benefit a gross area of 188,200 acres, had been planned or undertaken in 24 states.

DRAINAGE INCREASED ACREAGE OF CULTIVATED LAND

An analysis was made of the production benefits that would occur from 35 drainage projects. It was found that there were 30,502 acres in crops in these 35 projects before drainage and 34,266 acres in crops after drainage. All this land was in farms and no new farm units had been created. These projects, therefore, resulted in an increase of 12 per cent in cultivated land. Formerly, this amount of land had been idle or at best had furnished poor hay or pasture.

Corn was the crop grown most extensively on these projects. Corn plantings increased from 7,632 to 8,484 acres, or an 11 per cent increase. The average yield increase was estimated at 28 to 46 bu per acre, and the estimated gross production increased 175,100 bu, or 82 per cent due to improved drainage. Substantial increases were obtained in yields of soybeans. The crop area increased from 4,021 to 4,570 acres, and the estimated production increased by 70 per cent. Other war crops increased in a similar ratio.

The rehabilitation of drainage systems, however, is only part of the responsibilities of the engineer engaged in soil and water conservation work. Drainage must be provided for each acre in each field if the farmer is to receive the full benefits from the drainage system. It appears that one of the factors contributing to the delinquency in maintenance was due to the fact that farm laterals and field drains were not provided for in many original drainage enterprises. Without the laterals the main drains did not provide the benefits expected and in many cases the farmer was unable or unwilling to pay the assessments. Another factor that has contributed to poor maintenance on many systems is the rapid rate at which silt has been brought into the drainage ditches from eroding lands above. Large drainage ditches along the Tallahatchie River in Mississippi have been completely filled during one rain with sand and silt washed from cultivated land.

The engineer engaged in conservation work finds it necessary to plan a system of drainage for each field on the farm and in many cases to support such work with erosion control measures on higher lands if the best results are to be secured. The carrying out of this program is being encouraged through soil conservation districts. There are many examples indicating the benefits secured from better farm drainage.

On the W. J. Waits farm, Holmes County, Miss., the majority of the 1,027 acres is rather flat and has poor natural drainage. Before 1935 the AAA average for lint cotton was 129 lb per acre. In 1936 drainage type terraces and a drainage outlet were constructed to remove surface water. The yield of cotton has increased so that today the AAA average has been raised to 229 lb per acre. This year 210 bales were produced on 276 acres. On one field of 18 acres the drainage was so poor only two bales of cotton were raised in 1940. After drainage this field produced 12 bales. The drainage ditches were constructed by Mr. Waits with a farm tractor disk, and small grader, and the cost was low.

The T. W. Patterson farm consists of 150 acres of bottom land on the west prong of Lewis Creek in Mississippi. Before constructing a drainage ditch and laterals in the spring of 1941, 60 acres of land were too wet for crop production. For example, only 7 bales of cotton were produced on 59 acres in 1941. After the drainage was installed the same field yielded 40 bales. The yields of corn and hay have doubled since the ditch and laterals were built. Mr. Patterson estimates he received at least $1,000 more for crops in 1942 than would have been possible without drainage.

Ira B. Newson of Bishopville, S. C., says, "One of the several conservation practices demonstrated by the soil conservation district was the draining of a small bottom land field on my farm. The crops on about 2 acres of land in this bottom were always drowned out. This year after the ditch was put in I made 90 bu of barley on 2 acres."

In the field of irrigation the engineer's opportunities for real contribution to conservation and increased production are enormous. The 1940 census listed 91,637 individual irrigation enterprises covering 20½ million acres of land in the 17 western states. This land produces 90 per cent of all the sugar beets, 45 per cent of all truck crops, 25 per cent of all tomatoes, and a good share of the rice, citrus, and alfalfa grown in the United States. More than one-half the lambs fattened in the United States are on irrigated farms. Of the 20½ million acres irrigated, it is estimated that the systems supplying 11,700,000 acres are in need of repairs and improvements due to poor construction and inadequate maintenance.

Irrigation problems are generally included in one of the following categories:

1 Land in need of conditioning and improved irrigation methods
2 Need for rehabilitation or construction of individual farm distribution systems
3 Need for rehabilitation or construction of water supply systems.

In helping to bring about the adjustments needed to solve such problems, the primary objective of the Soil Conservation Service in irrigation agriculture is to enable farmers to secure the highest irrigation efficiencies consistent with good farming practices and economic operations.

SCS ASSISTS IN REPAIRING FLOOD DAMAGE

Annually there is extensive damage to many of these systems by floods and other causes that require immediate repairs if crops are to be raised. In 1941 two floods in the Rio Hondo in New Mexico washed out 41 of the 43 log and rock diversion dams supplying water to 6,000 acres of farmland. Soil Conservation Service engineers and Civilian Conservation Corps labor were made available to assist local people and by the spring of 1942 the dams were rebuilt and the irrigation systems ready for use.

In 1942 similar damage on the Purgatoire River in Colorado was repaired with the assistance of SCS engineers and a civilian public service labor camp in time to irrigate 15,600 acres of highly productive land in 1943. The estimated annual production from this land is 4,267 tons of sugar, 55,730 bags of beans, and enough forage to feed 4,000 head of cattle for a year, and sufficient grain to produce 450 tons of pork.

Many irrigation systems require improvements of a permanent nature to decrease maintenance and increase efficiency in the delivery of water. Frequently there is a loss of 25 to 40 per cent through seepage or leaks in the canals before the water reaches the farmers' headgates. The prevention of such loss is vital to the economy of many communities depending on irrigation water. Engineering services have been provided for planning repairs and improvements to irrigation systems supplying water for about 250,000 acres this year and another one-half million acres have been planned for improved irrigation practices.

The individual farmer finds that erosion damage is common, and in many cases severe, on sloping irrigated lands due to excessive heads and lengths of run. Leaching, water logging, and alkali conditions are often due to excessive use of water, while poorly adapted structures and irrigation methods require considerable more of the farmers' time for water application.

The farm distribution system must be fitted to the soils and topography so that the methods of application, particularly suited to the soils and crops, may be employed. The spacing of head ditches to adjust lengths of runs to soil and slope conditions, de-

vices for adjusting heads of water, positive division of water to fields, land leveling consistent with suitable methods of application, and efficient transportation of water are all mechanical aids designed to improve water distribution and to control erosion.

Excess water need not be applied if the farmer has information on the water-holding capacity of his soils and the requirements of the crops grown so that the proper time, rate, and amount of water application may be determined.

In the July, 1943, issue of "Soil Conservation", D. A. Williams writes: "Many examples could be cited to show that better irrigation means more production and less labor. A few typical cases will illustrate this point. The system of irrigation on a 100-acre sugar beet field in southern Idaho was revised to secure better water distribution. Lengths of run of the irrigation furrows were reduced from 1,200 to 400 ft, and simple control devices were installed. One less irrigator was required as a result of this revision and the yield of beets was increased from 12 to 17 tons, field average.

"Better distribution of water with no increase in labor for irrigating resulted in an increase of one-half ton of hay per acre on a 40-acre field in the Kittitas Soil Conservation District in Washington, when runs were reduced from 1,320 to 330 ft and corrugations were effectively spaced.

"By planning a seasonal balance between crops and water, a Nevada farmer found he could increase the acreage actually irrigated during the summer months by 24 acres. These 24 acres would raise the additional feed required for his dairy herd at no sacrifice of the other crops because he was to use that water which he had been wasting.

FARMERS INSTALL OVER-NIGHT STORAGE RESERVOIRS

"Many farmers in water-shortage areas of California have installed over-night storage reservoirs to provide more effective heads of water resulting in increased production and reduced labor. Scores of farmers have improved upon the method of water application as a result of technical assistance, for example: On the 190-acre citrus grove of the El Rancho Grande in Los Angeles County, California, irrigation and cultivation costs were reduced 40 per cent primarily by the adoption of the broad-furrow method of irrigation. Yields and quality of fruit have, at the same time, been materially improved."

On the O. H. Ward farm near Willard, Utah, severe erosion was in progress due to long runs on 64 acres of sloping land. An underground system was installed using 10-in pipe and 8-in risers. The job cost about $1,000, but the alfalfa crop was increased from 1 to 7 tons per acre.

The engineer engaged in soil and water conservation work has a variety of interests in equipment. First, there must be available for each job as needed construction equipment for building terraces, dams, drainage ditches, irrigation canals, leveling land for irrigation, and installing many other conservation practices. Secondly, the farmer must have available equipment adjusted to the needs of conservation farming if he is to secure the full benefits of the practices installed on his land.

The total job of constructing the conservation measures needed for physical land improvement in the United States is enormous. For example, a recent survey by the Soil Conservation Service indicates there is immediate need for terracing on over 90 million acres of cropland. If converted to miles, by assuming a ratio of 17 acres to the mile, 5,300,000 miles are needed. When viewed as a total, this job staggers the imagination, however, when it is considered that about 2¼ million farms are represented, the average job of constructing 2½ miles of terrace per farm is quite reasonable. Many of these farmers have available equipment adapted to the construction of terraces with their own power and labor. Disk plows, V-drags, small blades, slip scrapes, and fresnoes are all being used by farmers satisfactorily with little or no expenditure of money. On the other hand, many farmers prefer to conserve their labor and power at the expense of a cash outlay for terracing. To supply the demand for this type of terracing assistance the specially adapted heavier machines are needed to work on a contract or rental basis. In many soil conservation districts, their governing bodies have acquired such machinery for rental at an hourly rate to cooperating farmers. Other districts have sponsored private contractors doing terracing work or have made arrangements for the use of county or other pubic-owned equipment. Machines for drainage and land leveling and various other heavy work are furnished to farmers in much the same manner. Ordinarily soil conservation districts do not have the funds necessary to purchase construction equipment since they do not have authority to levy taxes or make assessments; consequently, other methods for securing equipment services must be used. The Soil Conservation Service owns a limited amount of such equipment which is regularly made available to districts with the expectation that in many cases the collections made for equipment use will enable the district to build up a reserve that can be used for initial payment on purchases. At the present time much equipment that would be used for this work is not available due to war conditions and for this reason many worth-while jobs have not yet been started.

Many farmers have all the power and equipment needed to carry on conservation farming; however, they must often learn methods of use consistent with conservation requirements. Other farmers find a need for additional equipment because adjusted land use has added new crops to their farms. A third group of farmers have equipment poorly adapted to conservation farming. This is particularly true in sections of rough topography where straight-row farming is changed to contour operations. Here the heavier trailing machines require excessive room for turning, and side slippage on transverse slopes makes their use impractical for many crops. The directly attached, more compact machines are superior for power farming under these conditions.

The soil conservation districts provide a local organization that can be valuable to the farm-equipment industry for carrying out demonstrations in the use of specially adapted farming equipment. The districts are interested in helping the farmers secure the equipment best suited to their present urgent job of increasing production by conservation farming. The industry, through its dealers and field offices, can be of great assistance to districts in this nation-wide enterprise.

Dairy Cow Housing Under Study

(Continued from page 85)

when born during cold weather. One of these had its ears frozen and the other was shivering severely. Both calves were taken out to the pen barn as soon as the weather moderated. Thus, with a little care at birth in extremely cold weather, calves will do well in a cold pen barn if a warm barn is not available.

SUMMARY

The project has not continued long enough for a complete set of conclusions to be drawn up; neither is it possible to evaluate each factor as accurately now as we hope to in the final analysis. The following will give a general idea of what can be reported at this time; and it should be remembered that these statements are made with the Wisconsin climate in mind:

1 High-producing cows in a cold pen barn may be expected to produce well within 10 per cent of the amount of milk they would produce in a warm stall barn. Daily production did not seem to be affected by changes in temperature.

2 Calves thrive in the cold barn almost as well as in the warm barn.

3 Bedding requirements of the pen barn are two to three times as great as in the stall barn.

4 Health conditions of both calves and cows were good in the open pen barn. There were no swollen hocks and knees as in the stall barn. Injured udders from being stepped on were not a problem in either barn. The stall barn was designed with stall widths of 4 ft 10 in and curbs between stalls to eliminate this cause of trouble.

5 In the pen barn the feed area should be separated from the bedded area and cleaned daily.

6 Space should be provided for from 3 to 4 ft depth of manure in the loafing area and approximately 75 sq ft of area per large cow. The manure pack is solid and covered with clean bedding at all times. Less space will reduce cost but increase bedding requirements to maintain cleanliness of animals.

7 To be satisfactory, the milking parlor must include the following:

(Continued on page 95)

The Farm Building Repair Program

By J. C. Wooley

MEMBER A.S.A.E.

THE old New England saying "fix it up, wear it out, do without" is finding application in the farm building repair program as well as in other of our wartime activities; and well it should for we all must cooperate in saving. However, we must be careful that we do not carry our saving to the point where it interferes with our main objective, the food production program.

Our problem is larger than normal at this time because of ten years of accumulated neglect of farm buildings. During the time of prosperity following World War I, farm buildings were repaired and put in very good shape in this country. Then came the depression when farmers did not have the money or the desire to do very much repair work. They were in no position then to put money into any long-time investment. When the period of increased prices in agriculture returned, building materials were needed for the promotion of the war effort and even though the farmer had the money and the desire to put his buildings in good shape, he was then not able to do so. Therefore, we have nine or ten years of accumulated need for repair of farm buildings.

There is also another important factor that enters into this repair problem, making it larger than normal. During this nine or ten-year period of few repairs there has also been a reduction in replacement of buildings. Buildings which would have been torn down and replaced with new ones are still being used. This adds to the repair problem at present. Instead of the normal amount of repairs we have this additional group of obsolete buildings to keep in repair for the duration.

Thus we have two kinds or classes of repair work. One would come under the head of *patching* and the other would be classed as *restoration,* or putting the building back in as good condition as it was when new.

Before deciding whether to patch or whether to restore a building, we must consider several factors. Is the building one that fills the need or can be made to fill the need of the farm now and in the future? Is the building the proper size and has it the proper interior arrangement? Is it located to facilitate field work as well as work about the farmstead? Is the building in sufficiently good mechanical condition to warrant spending money on it? The frame work and the principal parts must have some potential value to justify a program of restoration. Will postponing repair result in damage to the building? Will it create a dangerous condition for workers or for livestock? Will it result in improper environment for livestock causing loss through reduced efficiency from disease and exposure? Will lack of repair result in damage to feed stored in the building? Feed becomes food and it must not be allowed to deteriorate, especially after it is placed in storage. Will the lack of repair make chore operations more difficult or more hazardous? At the present time the family is called upon to do a great deal of the chore work because the men are needed for the work on major enterprises. Buildings, gates, and fences in good repair make it possible for the children and the womenfolk to do a larger part of the chores than is the case where gates and doors are difficult to handle and require a man's strength to operate them.

The farmer's answer to these questions will determine whether he will leave his buildings as they are, follow a program of patching, or go in for a complete restoration of them. When he has decided to repair a building he should give some consideration to the conditions that caused the previous failure and see to it that the same conditions, if possible, do not hold after the repair has been made. In a great many instances the lack of care of roof and yard drainage is the cause back of many foundation, sill, and framing failures. Repair of gutters, down spouts, or the installation of tile drains or surface gutters of concrete may be essential to protect his investment in the building. In addition to this the drains may serve another purpose, namely, to keep feed yards in better condition for livestock and for chore operations.

It may be that *mechanical damage* has been the cause of previous failures. Poor nailing is one cause of rapid deterioration of siding. If nails are driven in, to the point where wood is bruised around the nail, early failure is sure to result. Therefore, good quality of workmanship pays dividends in making repairs as well as in new construction. Damage to siding often comes from *livestock, single-trees* of farm wagons, or *hubs* of wagon or tractor wheels. Some arrangement should be made, by flaring the foundations or building concrete barriers, to keep wagons and other implements from getting too close to the siding on cribs or barns. Many times buildings are damaged when *elevators* are inserted into doors or when the *straw stacker* on the threshing machine is placed in or pulled away from the barn. Contractors who come to the farm to shell corn many times tear off the side of a crib, the main thought being to get the *shelling* job done and on to the next one. This kind of damage can be avoided by preparing ahead of time for such work.

Inferior design is often a factor. For example, it usually requires two sets of barn doors to wear out a barn. The doors stand open a great deal of the time. The inside of the doors is not designed to shed rain and they absorb moisture and are then exposed to wind and sunshine. The hardware is not often properly painted when it is installed and rusts from the under side as well as from the outer. *Poor ventilation* causes rapid depreciation in many buildings. Hog houses and poultry houses especially are often covered with frost on the inside in cold weather due to lack of insulation and ventilation. Such a condition if allowed to prevail for any length of time will cause rotting of the sheeting and rafters, and much earlier failure of the building will result than would otherwise. A building that requires early repairs due to such conditions should certainly be insulated and ventilated when repaired, not only for the sake of the building but also for the livestock housed in it. High depreciation in concrete work comes, a great many times, from the use of *dirty materials,* by using a too *lean mixture,* and by lack of *reinforcement* at points where it is most essential. Reinforcing around the corners and near the top of foundation walls will prevent a great many failures. Inadequate depth and width of footings come in for a share in foundation failures. *Horizontal siding* on high sidewalls usually fails rather early because blowing rains force the water between the boards and inside the building. This causes not only early failure of siding but of the framing as well. Vertical siding on these high walls sheds the water to much better advantage and depreciation rates are less on a building so constructed. All these points are of course very important in the design of a new structure and should receive some consideration in the repair work, especially if it comes under the class of restoration.

I realize that these statements in regard to the necessity for and desirability of repairing farm buildings and the methods of carrying out the process are not news to the members of the A.S.A.E. Farm Structures Division. This is the group that has the know how to be of service to the fighter on the food front — the farmer.

Now let us look into some of the ways and means at our disposal for rendering this service. Before we start on a program for the repair of farm buildings we would do well to make a thorough study, set up our objectives, and plan our activities on a realistic basis. This study should start on the farm, with the farmer, because this is the place where the work will be done and the farmer is the individual who will plan and perhaps do the job. In many cases the farmer will need to be motivated in this program. He may be too close to the problem to see it. The need for repair on a barn develops slowly. He is in such close contact with his buildings that he may not realize that the program is for him.

His interest can probably best be secured through the press by use of a series of news stories, and here is where we should start our program of cooperation. *(Continued on page 92)*

This paper was presented at the fall meeting of the American Society of Agricultural Engineers at Chicago, Ill., December, 1943, as a contribution of the Farm Structures Division.

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Wartime Repair of Farm Structures

By Charles A. Matthews
ASSOCIATE A.S.A.E.

WHILE the farm machinery repair program that has been so successfully carried on during the last year or two is necessary and thoroughly commendable, we should be derelict in our duty as agricultural engineers if we failed to recognize that there is an equal necessity for a similar program for the repair of farm structures. That is, we have the same opportunity and responsibility to do a job in wartime maintenance and repair of farm buildings that is of equal importance to the job that has been done in the repair of farm machinery.

After all, farm people constituting as they do the second line of defense must be comfortably housed; huge crops must be safely stored to prevent spoilage, and livestock raised through the expenditure of much time, effort and money must be protected from the elements. All these things are vitally necessary in order to conserve successfully crops produced as a wartime measure.

Essential repairs of buildings cannot wait until the war is over; they are a definite part of the battle of farm production. I desire to make it clear that I do not advocate a wholesale, comprehensive farm structures repair program, but only *essential* repairs; and by that I mean those repairs which will enable farm structures to give safe, adequate, and necessary shelter to farm people, their crops, their machinery and their livestock, and that will prevent dangerous depreciation or even complete collapse of these structures.

During the past two years, in carrying on work incidental to a comprehensive roofing survey in a number of states, I have observed farm buildings very closely, and I am impressed with the urgency of the need for farm building repair. In the six states of Ohio, Indiana, Michigan, Wisconsin, Missouri and Oklahoma the buildings on 1,400 farms were carefully examined; data was taken on the condition of the roofing on all buildings. Thirty per cent of the metal roofing was found to be very rusty and would rapidly deteriorate if paint was not immediately applied. Likewise 30 per cent of all wood shingle roofs needed immediate replacement, as did 17 per cent of rolled roofing and 21 per cent of asphalt shingle roofs. In hundreds of buildings, foundations were disintegrating, sills were crumbling, rafters were cracked and sagging, studding was rotted, and floors had broken through.

Such conditions demand immediate attention; rot and rust are taking their toll every day; these building materials have served their life and will no longer serve in the battle of production. They must be renewed — NOW.

When visiting the agricultural engineers of the University of Missouri last February (1943), the seriousness of the farm structures situation was discussed, with the idea of developing some practical solution of the problem. It was decided the first thing needed was to make a survey which would provide definite data upon which to base a repair program. Twenty counties were selected in which to make general observations and in two counties, Cole and Pike, which are fairly representative of the twenty, specific and detailed observations were made. The county agents in these two counties were consulted and their recommendations followed in regard to the choice of farm locations so that we would get a fair sample of the farm buildings, good and poor. They accompanied us in the preliminary inspections and helped obtain the complete and enthusiastic cooperation of the farmers themselves. In each of the two counties the buildings on twenty farms were completely and carefully inspected.

Observations were made of foundations, sidewalls and roofing. The need of paint both for the buildings themselves and for the roofs was carefully noted. Here is a brief summary of the data* obtained on the repairs needed, expressed in percentages:

	Houses	Barns	Other buildings
Foundations crumbling	17	25	20
Framing rotted or broken	3	11	11
Siding in bad condition	17	37	22
Buildings beyond repair	3	14	16
Buildings never painted	5	34	50
Buildings needing paint	53	65	55
Average years since painted	5	8.5	7

Because I was particularly interested in the condition of metal roofing I collected and summarized data pertaining to 330 buildings which were included in the detailed survey in Cole and Pike Counties and on 3,874 buildings in the general survey made in the 20 counties. The condition of the metal roofing on these buildings is summarized in the following table:

	Detailed survey of 2 counties (330 buildings)	General survey of 20 counties (3874 buildings)
Per cent having metal roofing	71	57
Per cent of roofing now rusty	60	70
Per cent of roofs not painted	79	81
Average time of failure of roofing paints	2.5 years	2.5 years
Per cent of roofs needing renailing	52	50
Per cent of roofs not grounded	94	98

With this data in hand it was decided that a program of building repair was urgently needed. It was further decided that the program should be carried out as part of the activities of the agricultural extension engineers. The 20 counties originally surveyed were included in the arrangements for a program which would be in the nature of a test program, to be carried on during the present year.

A farm building repair program gets under way

The American Zinc Institute offered its cooperation in the way of personnel assistance and in the supply of materials which could be used in demonstrations of proper roofing repair.

Each of the county agents in the 20 counties was called upon, the problem presented to him, and his cooperation and suggestions for its solution sought. It is significant that every one of these agents, after going over the data and associating it with their own observations in their own counties, agreed that it was an important problem deserving immediate and careful attention. All requested demonstration materials for use in farmer meetings to show the basic facts. They asked for copies of our data as well as printed material which could be distributed to give definite information about suitable repair materials and best practices in using them.

Without calling special meetings for this purpose alone the county agents are putting on roofing repair demonstrations at various meetings in their counties. They tell farmers about the results of the survey and add data from their own observations. They explain the right methods of renailing loose roofing material, how to use sheet metal screws to close gaps, and how to use

This paper was presented at the annual meeting of the American Society of Agricultural Engineers at Lafayette, Ind., June, 1943, as a contribution of the Farm Structures Division.

CHARLES A. MATTHEWS is field representative, American Zinc Institute.

*Data supplied by Ralph Ricketts, extension agricultural engineer, University of Missouri.

asbestos wicking as gaskets in laps to stop roof leaks. They explain the desirability of steel brushing to eliminate the loose rust and thus provide for better adherence of the paint and more uniform and greater coverage. They emphasize the necessity of using proper paints for the purpose. With the use of a small building model they demonstrate how metal roofs can be economically grounded and thus made completely safe against danger from lightning. They also demonstrate the proper method of applying galvanized sheets that are salvaged from obsolete buildings.

In any farm community almost are to be found buildings in a condition similar to this one

This program, which is merely a preliminary test program to give valuable suggestions in developing a larger and more general program, is now being organized. It is planned to cooperate with the county agents in one or more actual farm demonstrations in each county. The county agent will select the farmstead and the particular building and will make all advance arrangements, including the necessary announcements and publicity. At these demonstrations we will work with the cooperating farmer in actually doing the same things the agent has already shown in his demonstrating at meetings. News stories will carry the influence of this demonstration program over the entire county and state. The final record of accomplishment with this program will be provided by each agent in his final report at the close of the year. Just how far reaching will be the effect of the demonstration work is of course yet a question. But if the interest of the county agents and the farmers themselves, who already know something about the program, is any criterion we feel confident that a great many galvanized roofs will be rehabilitated before the end of the year.

While I have emphasized the part which our organization has played and expects to play in this program, I should like to make it clear that the program is not at all exclusively a roofing repair program. It is the intention of the Missouri extension agricultural engineers to cover other phases of farm building repair in much the same way, perhaps not in quite so much detail but nevertheless making use of actual farm demonstration methods. As an example, a representative of the Portland Cement Association cooperated during part of the time when our detailed survey was being made, and his organization is planning to cooperate in farm demonstrations relative to foundation repairs, concrete floors in poultry houses and dairy barns, and similar rehabilitation work. It is entirely possible that other organizations, such as lumbermen's groups, paint manufacturers and insulation companies would readily respond to similar proposals.

This method of dealing with wartime problems of essential maintenance of farm structures coordinates the activities of agricultural engineering staffs, the extension organizations and the forces of organized industry, along with the farmer himself, for successful prosecution of the job. It makes the job interesting, even exciting, and it stresses its real importance. In my judgment it is a sensible and practical program that will succeed in contributing something definite and worth while toward the solution of the farm building repair problem in Missouri. At the same time it is of definite educational value and provides inspiration for others to go and do likewise.

The Farm Building Repair Program

(Continued from page 90)

Practically every land-grant college has an agricultural editor. Every company or trade association has its publicity department. If we at the colleges will give the editor the facts on any subject, he will make a news story out of them for us. In fact, if you will submit yourself for an interview, he will get the story with a minimum of effort on your part — and not one story but a series of stories planned with our objective in mind.

First, we should have one or two stories connecting our program to that of food production. Stress the fact that buildings are a part of the farmers' tools of production. If they are in good working condition they save his time and energy, they save feed, they furnish a better environment for animals, and therefore, help to get more to the market and in better condition.

Our second series of stories should stress the economics of the repair program. Repairs reduce depreciation more than they cost. They increase the efficiency of the farmer's production plant and in addition give him much in satisfaction.

The third series should be illustrated as much as possible and should show common failures and the methods of making the repairs. This is the series that will help the farmer to see his own problems and a suggested solution.

The fourth series should show before-and-after cases if possible. These are convincing and help to keep the program going.

The agricultural editor will supply the county agricultural agents with the stories ready for their use locally. I have already taken for granted the fact that the county agent will be interested in the program as will also the vocational agriculture teachers. They will be able to use charts, slides, film strips, bulletins, and booklets that are concerned with materials, construction, and repair. The farm building specialist at the state college is best prepared to supply these helps. This is an effective field for some leadership training. A conference with this group in each county or region and perhaps assistance with a meeting or two will probably be necessary.

There are two other groups that should be contacted. The lumber dealers and the country carpenters. These two groups have a great deal of influence with the farmer. They are his consultants on building problems. In Missouri we are supplying all lumber dealers with our catalogue of plans and with other bulletins relating to construction or practices influencing it. Through the cooperation of the Portland Cement Association we have been able to supply 650 country carpenters with what we call a handbook. This is a compilation of bulletins with a subject matter index to enable them to find the information they need. These are bound so that additions may be made as new bulletins are issued.

Our farm building repair bulletin (No. 279) has been sent to a selected list of farmers and of course to all cooperators, with a supply for distribution to county agents and vo-ag teachers. Check sheets are being sent to county agents and vo-ag teachers for distribution. Repair booklets published by manufacturers of building materials have been distributed through lumber dealers and will add to the information supplied to the farmer. We now have from 500 to 1000 people working on our program. These people will all help us because it is to their interest to do so. The publicity man is always looking for news; the county agents and vo-ag teachers will be able to increase their service to the people, the lumber dealers will make sales and cultivate the farmers' good will, and the carpenters will secure employment. If you want a cooperator, enlist one who will benefit by the cooperation and you will be sure of his interest and help.

We have set up a large program. Let us go back and see just what we are going to expect each cooperator to do.

First, the farm building specialist is to furnish facts to the publicity men and encourage them to keep the program in the news. He is to supply charts, slides, bulletins, *(Continued on page 93)*

Postwar Plans for Soil and Water Conservation

By M. L. Nichols
FELLOW A.S.A.E.

FOR some time agencies of the U. S. Department of Agriculture have been working on the development of plans for postwar agriculture. This work has been under the general direction of Dr. Howard R. Tolley, chief of the Bureau of Agricultural Economics and Mr. R. C. Smith. While these plans are far from complete, outlines and suggestive material have been drafted for important phases of the agricultural field and many groups and individuals are giving considerable thought to programs for the readjustment from a war economy to peacetime conditions.

In general, the industrial conversion from the manufacture of munitions and supplies to peacetime industries and the returning of many millions of soldiers to civilian life will require careful planning and organization to avoid serious disruption of the national economy. While it seems to be generally agreed that private enterprise will in all probability be able to "retool" to peacetime operations quickly and avoid large unemployment problems, nevertheless the government has a responsibility to have prepared plans for the gainful employment of workers should there be need for this type of labor outlet. If such is the case, it is necessary that such plans be carefully made so that efforts along this line are directed towards real needs and organized to avoid unnecessary expenditures or extravagance.

In the field of agriculture, it would seem that the agricultural engineer should have a very real responsibility. If he is to meet this responsibility, he must start planning now since no one knows when the war will be over, and those who are in the best position to know appear to be thinking in terms of months rather than years. We have a real basis for planning. We know, for example, that the farmer will need large amounts of equipment since replacements have been almost impossible for a period of years. We know that farmers have been unable to construct necessary new buildings and repair those they now have. We know that there will be a continued demand for foodstuffs, probably at a relatively high price. Tentative plans have been made for considerabe development in the field of irrigation and a considerable development in the field of drainage. We can also expect a very great amount of activity in repair and improvement of existing facilities in both of these latter fields.

Another general undertaking which is of far-reaching importance in the national economy will be extensive work for flood control and water regulation. The agricultural engineer should play an important part in this work, particularly in the field of agricultural hydrology. The Soil Conservation Service has set up cooperative investigations in 24 states to determine the effect of agricultural practices on water control and regulation.

For the sake of general information, I should like to mention a few of the items which are considered in the "Topical Outline for Planning Land-Resource Conservation and Development" which is being used as a general guide by the Department's personnel giving attention to postwar programming in the physical resource field. The planning applies, in general, to all kinds of land including crop and pasture lands, range lands, and forests. Among other things it is provided that the plans should consider (1) the problems or objectives of the undertaking and (2) what value these undertakings when completed will have for the employment of labor to aid in the adjustment. The relative urgency and importance of the work, effective timing of the work, and rate of operation which will best promote efficient and economical accomplishment are important considerations. Other practical considerations which must be taken into account are local sentiment and understanding, need for further research, availability of suitable labor and equipment, and the extent to which the execution of the work will require adjustment in private ownership or occupancy. It is provided further that the plans must set forth amounts of materials; the labor requirements including supervisory, technical, skilled, and unskilled workers; the nature, magnitude, and general location of proposed works, and probable benefits. The plans should indicate the extent to which any proposed project will be self-liquidating.

Some of the specific items of a capital improvement nature which are being considered for projects are (1) water disposal systems, (2) water conserving systems, (3) stock water facilities to promote pasture conservation, (4) fencing, (5) preparation of land for conservation farming, (6) stream bank improvement, (7) highway erosion control systems on secondary roads, (8) rock quarrying and processing, (9) sand dune stabilization, (10) intensification of suitable conservation practices on crop and pasture land or alteration of such practices necessary and practicable to bring about a greater value for flood retardation or control purposes, (11) improvement of storage for irrigation water, (12) rehabilitation, repair, or improvement of existing wells and springs and sources of water supply, (13) the installation of drainage facilities for irrigated areas including facilities on individual farm units, (14) special flood control and runoff retardation structures which can be justified on the basis of alleviation of floods on tributaries of main streams, (15) prevention of flood and siltation damages by means of small dams, dykes, levees, stream bank work, and debris basins upstream, (16) land clearing and leveling programs, (17) programs of revegetation, (18) noxious plant control such as clearing and eradication of mesquite and other brush, (19) fire control, (20) the planting of windbreaks and shelterbelts, (21) construction of dipping vats, etc.

It is our understanding that state and local participation and cooperation with federal agencies will prevail in the formulation of postwar planning in the field of agriculture. Farm organizations should and no doubt will cooperate in this work and particularly in helping see to it that discussions among farm groups about the needs of agriculture take place. Leadership for the overall national planning in the Department of Agriculture will be handled through the Bureau of Agricultural Economics in cooperation with the other groups and agencies. The Association of Land-Grant Colleges and Universities is appointing a committee of extension and experiment station directors and deans of agriculture to cooperate with the planning on a national level. The state planning will probably be handled by agencies within the states and in practically all cases the land-grant college group will play an important part in taking the leadership in the state planning, assisted by other state agencies, farmer groups, and federal agency personnel. As yet we do not know what action will be taken by Congress for the federal part of the program beyond what may be accomplished from existing appropriations, but it is anticipated there will be some program of this nature with probably some similar action by state and local agencies.

Paper presented at the fall meeting of the American Society of Agricultural Engineers at Chicago, Ill., December, 1943. A contribution of the Soil and Water Division.

M. L. NICHOLS is chief of research, Soil Conservation Service, U. S. Department of Agriculture.

The Farm Building Repair Program

(Continued from page 92)

check sheets, etc., to county agents and vo-ag teachers and give them guidance and encouragement. Whenever necessary, he is to hold conferences with them and assist in meetings to get them started. He is to supply lumber dealers and carpenters with plans and information on construction. He is to encourage county agents and vo-ag teachers to help keep a record of repair jobs completed. A summary of these at the end of the year gives a measure of the effectiveness of the program and adds stimulus to future work.

The county agents and vo-ag teachers are to localize the news stories as much as possible, hold meetings, give demonstrations, etc., in different communities. Lumber dealers and carpenters are to consult with interested farmers on repair and remodeling problems.

The final goal is efficient service from farm buildings. With a working organization similar to that described functioning in each state, our goal will be reached and we will have made our contribution not only to the war effort but also to the pressing peacetime needs beginning to appear on the horizon.

Germicidal and Heat Lamps for Poultry

By Lawrence C. Porter

FELLOW A.S.A.E.

ON THE assumption that agricultural experiment stations as well as manufacturers are now making plans for postwar activity, the following suggestions are offered for a line of research that might have far-reaching benefits in the poultry industry.

In spite of the best medical practice in hospitals, disease still is transmitted from one patient to another, even sometimes in epidemic magnitude. Of much more frequent occurence are epidemics of measles, mumps, streptococcic sore throat, chicken pox, colds, and influenza in schools where sanitation is not as thorough as in hospital practice.

Medical research has established beyond a doubt the fact that such diseases are often transmitted from one person to another by means of air-carried germs. It has long been recognized that if some means were available for economically disinfecting large volumes of air, as we now chlorinate water and pasteurize milk, it would go a long way toward the control of the spread of disease. The introduction of the germicidal lamp which emits relatively large amounts of shortwave ultraviolet radiation made practical the killing of air-carried bacteria on a large scale.

During the past five years extensive and thorough research on the use of such lamps has been conducted under competent medical supervision. Following the research work many practical installations of germicidal lamps have been made in hospitals, schools, army and navy barracks, and even in offices and homes. Today there are thousands of lamps in use, and equipment is available which is approved by the American Medical Association.

There is every reason to believe that the use of germicidal lamps in poultries would control the spread of respiratory diseases among chickens as it does among human beings. The methods of application, however, have yet to be worked out as conditions in poultry houses are quite different from those in human habitations.

In general, germicidal lamps are applied in hospitals and barracks in two ways. One is to mount them on the walls and under beds to irradiate the upper and lower portions of a room without having any of the germicidal radiation fall directly on the occupants. Air currents—either natural, convection, or forced — are depended upon to circulate the germ-laden air from the unirradiated areas of the room into the irradiated portions where the ultraviolet kills the germs. In schools the lamps are used in sidewall fixtures.

The reason that radiation is kept off the occupants is that if it falls on bare eyes it causes conjunctivitis, and on bare skin, erythema or sunburn.

Another method of applying lamps is to put them in the air ducts of air-conditioning systems. This method is not so effective nor so efficient as the former; nevertheless a single 30-w lamp so used will disinfect from 500 to 600 cu ft of air per minute passing over the tube. Sometimes a combination of the two methods is used. Germicidal lamps could be used in the air ducts of incubators and in forced draft brooders.

A surprisingly small number of lamps will do an excellent job. For example, a single 30-w lamp will free 4,000 cu ft of air of germs to the same extent that 100 changes of air per hour would do.

Chickens' eyes, as well as those of human beings, are susceptible to soreness caused by shortwave ultraviolet. On the other hand, there seems to be evidence that a certain amount of such radiation can be tolerated. There is some evidence also that the radiation falling on the birds' legs will produce vitamin D, even to such an extent as to make up for an absence of all sources of vitamin D, such as cod liver oil, in the feed.

One method of applying the lamps that might be quite effective and at the same time protect the eyes of the birds and their attendants alike is to mount the tubes under feeders, waterers, roosts, or nests, with a baffle beneath the lamps to confine their radiation to a relatively narrow zone above the heads of birds on the floor but below the eyes of those on roosts or in nests (Fig. 1).

Careful laboratory research is needed to determine (1) what intensity of germicidal radiation and how long an exposure chickens can tolerate without injury to their eyes; (2) how much radiation is necessary to supply birds with an adequate amount of vitamin D, (a) as the entire source of it and (b) to supplement that received in the feed; (3) whether or not the radiation reduces the mortality from any of the air-borne poultry diseases.

After these facts are established the most practical means of applying this radiation to poultry must be worked out. One very serious difficulty is that of dust. Obviously trough type wall fixtures similar to those used in schools and hospitals would not be practical in dusty poultries.

There have been apparently successful poultry installations using bare lamps mounted close to the ceiling in the poultry house that have not bothered the eyes of the birds and are claimed to have resulted in remarkable reductions of mortality and faster growth of young birds.

After adequate laboratory research and development of practical installation methods the next step should be some rather large-scale installations in half of a large poultry plant where all conditions except the use of lamps would be identical in each half of the plant. Accurate records should be kept for each half of such things as mortality, rate of growth, egg production, etc., and comparisons made of the costs of installation and operation versus savings in elimination of sources of vitamin D in the feed, losses due to mortality, lower egg production, etc.

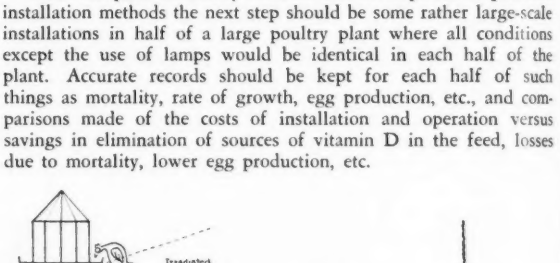

Fig. 1 (Left) This view shows one method of applying germicidal lamps • Fig. 2 (Right) A heat lamp hung over the feeder outside a brooder

Another thing that has been tried out and found quite effective is to hang a 250-w R-40 heat lamp over the feeders just outside of baby chick brooders (Fig. 2). The lamp is usually suspended at such a height (2 to 3 ft) as to just nicely cover the feeding area. The light from the lamps helps coax the chicks out from under the brooder and keeps them warm while eating, thus avoiding the shock of coming out of a brooder at 90 deg onto a cold floor and into air that may be anything from 60 deg down. Reports on this supplemental heating indicate not only reduced mortality but also about two weeks earlier maturity.

When RS sunlamps again become available they would be still better than heat lamps because in addition to the heat they would furnish the chicks with an adequate dosage of ultraviolet.

Article prepared especially for AGRICULTURAL ENGINEERING.

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The Value of Farm Buildings

THE war, particularly the food production program, has focused attention to the need and value of farm buildings as has never been the case heretofore. The need was felt primarily because of insufficient shelter for the increasing numbers of farm animals and lack of suitable storage space for farm crops, resulting in much loss.

A tremendous loss is being sustained by farmers because structures do not meet standard sanitary requirements to safeguard the health of the animals and to protect farm products from deteriorating or becoming worthless before reaching the market. Then too there is the further loss on account of the inefficiencies in the planning of the related buildings which results in much loss of precious time. Many farm improvements like paved feeding floors for hogs and cattle more than repay their cost with each year's use through feed saved, greater poundage of beef and pork produced, improved health of the animals, and the saving of labor for the farmer. It is in times like these that the value of farm improvements as a means of producing and conserving food is realized.

Another Answer to "Plowman's Folly"

TO THE EDITOR:

FOR some time I have wondered if an answer to "Plowman's Folly" would be forthcoming, and I am genuinely impressed with the conclusions and summary of results in .e article entitled "Present Status of the Plow as a Tillage Implement" by Norton, Collins and Browning, in AGRICULTURAL ENGINEERING for January.

Because of the reduced cost of seedbed preparation, many of the operators on this irrigated project of 20,000 acres have resorted to surface tillage preparation for both grain and corn which are of prime importance in winning the war.

Results in yields in contrast to plowed land have been very unsatisfactory in most cases and considerable irrigation water wasted by surface runoff through inattention to water spreading on a compact seedbed incapable of absorbing water freely. Many other factors naturally affect yields and cost of production under local conditions; however, years of practical experience under these same conditions indicate that the net returns from plowed land is consistently greater than from surface-tillage preparation.

Character and depth of soils or differences in soil types influence profoundly the selection of tillage implements. As a member of the Colorado state AAA committee I have failed to find one single county agent in the "Plains Area" portion of this state who would recommend the excessive use of the one-way disk plow as a soil conserving operation. While this type of plow, closely related to a surface-tillage machine, is classed as a semisurface tillage implement, excessive soil losses followed its use in wind-hazard areas during "black blizzard" days, because of its misuse in continually pulverizing the dry soil.

The moldboard plow, as we know it, is the basic tool of the farm and can be said to be the foundation of civilization. Down through the years we strive to accomplish the following results with it: (1) Obtain a deep seedbed of good texture, (2) create a mellow soil for the seed, (3) add more humus to the soil by covering trash, crop residue and other forms of fertilizer, (4) destroy and prevent weeds, (5) leave the soil in such condition that air will circulate freely, (6) leave the soil in such condition as to receive and retain moisture from rain and irrigation water, (7) destroy insects as well as their eggs, larvae, breeding places, (8) incorporate organic matter into the soil to resist erosion and to provide a surface mulch for conserving moisture, (9) prevent washing of soil through plowing on the contour (five inches of such soil will readily absorb an inch of rainfall), and (10) increase the cohesion of the soil by increasing its water content by increasing the amount of humus which it contains and controlling its roughness for the prevention of wind and water erosion.

Remembering that the transporting power of running water varies as the sixth power of its velocity, or that doubling its velocity increases its carrying power sixty-four times and trebling its velocity increases its carrying power 729 times, it would seem necessary to keep enough organic matter plowed into the soil to effect a condition that binds the soil particles into granules which tend to make the soil more porous thus increasing its porosity for water absorption and thus lessening its washing or erosion.

A thorough job of seedbed preparation results as a rule in economy in cultivation. By good methods of plowing and seedbed preparation the growth of the seed is rendered more certain and more uniform, yields are increased, and the cost of later cultivations and loss of soil moisture may be greatly reduced.

Farm managers and farm operators in the arid areas generally do not discredit the use of surface tillage, or the maintenance of a surface mulch in the production of certain crops, but they do consistently oppose any discredit of the plow and plowing as a necessary, efficient, and most useful farm implement and agricultural operation.

Methods of cultivation vary under different climatic and soil conditions, as well as under different cropping systems. The losses of nitrates from soils are considered greatest from wheat harvest to spring plowing and least during the summer months. This teaches a most important principle, namely, that ground should be kept in some crop as much of the time as possible especially during the fall and winter. Corn land should never be left fallow through the winter. The same is true of tomato and truck crop land.

Following through a system of surface tillage is practical in certain areas of the arid region on non-irrigated land. Three reasons are given for this system: (1) To conserve moisture, (2) to eradicate weeds and conserve plant food, and (3) to condition the soil for production of satisfactory crops. Mulching, disking in the fall, early surface cultivation, summer fallowing and winter tillage —all have a proper place according to farming methods, climatic conditions, and type of crop.

Plowing properly done according to season and with a proper soil condition and a soil filled with humus has the following advantages: (1) It provides more food because it increases chemical action and multiplies bacterial life in a larger body of soil. (2) It stores more moisture and looses its moisture with less rapidity on account of its cooler lower strata and abundant humus. (3) It increases the number of roots the plants will throw out. (4) It allows plants to root deeper and find a more permanent moisture. (5) It replaces terracing to the extent that heavy rainfall will be largely absorbed. (6) Plowing under organic matter enables the soil to store more moisture, increases its temperature, makes it more porous, furnishes plant food, stimulates chemical action, and fosters bacterial life. And remembering that an average soil will sustain an inch of water per foot in depth for the use of growing crops, we highly recommend the continued use of the plow.

The subject "Plowman's Folly" is most certainly an interesting one and worthy of serious consideration and discussion by agricultural engineers, Extension Service workers, and farmers.

CHAS. E. WHITE

Resident manager, Beaver Park Co.
Penrose, Fremont Co., Colo.

Dairy Cow Housing Under Study

(Continued from page 89)

(a) Milking stalls at least 3 ft 9 in wide for large cows.

(b) Enough stalls to allow for not more than 5 cows per stall each hour during milking and feeding of concentrates; 12 min is about the minimum time for the cow to come in, eat grain, be milked, and go out.

(c) Insulation, heat, and ventilation are needed.

(d) Running water, floor drain, sediment trap, and waste disposal are a necessary part of the milking parlor or milking room.

8 Milk of high quality can be produced in the pen barn milking parlor as it is clean and free from bad odors. Morning milking in the stall barn is usually done over a gutter filled with manure.

9 In planning or designing a stall barn the addition of more cow pens for the average barn would seem to prove to be a profitable investment. The health of cows confined to stanchions can be protected if they can be placed in a pen at the first signs of joint injury, loss of appetite or other trouble where freedom of movement might help. These pens can have a cow in them at all times so each pen will at least take the place of one stanchion or stall.

Bring in the Bankers

(Continued from page 78)

As agricultural engineers we can no more offer detailed advice to bankers than they can compute terrace dimensions. But they have so much to gain from soundly engineered farming in their communities, and we have so much to gain from the wise cooperation of bankers in fostering the adoption of advances which we develop, that we may well cultivate closer relationships. This always is true, but applies with special force to the impending period of farm re-equipment and change-over to conservation methods.

Debeaking Poultry

By Jim Lyon
MEMBER A.S.A.E.

FEATHER pulling, tail-vent-toe picking are no longer a problem with broiler and fryer producers. Heat up the BILLOTINE, snip-burn off upper beak tips", says W. E. Newlon, University of California poultry extension specialist, as reported by D. M. Rutherford.

Bill Newlon has been a disciple of debeaking since the University of California discovered the practice in the extreme southern part of California. Dr. J. R. Beach, Dr. W. R. Hinshaw, and others active in the University extension system appeared favorably impressed by the results of debeaking and a state bulletin on this subject may be forthcoming. The need for a cure of "cannibalism" is much greater than the average person realizes, and unfortunately the best birds — the good layers — are the first to die. Not infrequently losses from picking make a sad failure out of what would otherwise be a successful farm project.

San Diego County (California) was apparently the birthplace of debeaking or beak cauterizing on a commercial scale. The practice of consistent beak burning evidently was started four or five years ago by T. E. Wolfe. Other poultrymen noticed his results and also adopted the system. This provided groundwork in the way of field research tests, for Bill Heidl of the San Diego Cooperative Poultry Association. Mr. Heidl took note of the fact that birds from ranches where beak burning was practiced were consistently of better quality when marketed than were birds from other ranches. He saw that picking was eliminated 100 per cent and that bird nervousness was greatly reduced. The results were so consistently favorable that Mr. Heidl encouraged other poultrymen to debeak. Bernarr Hall of the San Diego County farm advisor's office became interested and also conducted some experiments. A large number of poultrymen are now debeaking throughout the country. Every one trying this method has been enthusiastic about the results, which are more than a simple and absolute cure for cannibalism. Additional advantages have been reported by a number of poultrymen.

A saving in feed or a greater gain in weight per bird from the same amount of feed results. The County Agent's office reports that the average increase in weight is around 10 or 15 per cent. C. T. Moyle states that his increase in bird weight was 20 per cent on the same amount of feed. These reports are quite accurate because the operators were on a consistent program and some of them also conducted check pens.

WASTAGE REDUCED AND UTILIZATION INCREASED

The reason for a saving in feed is two-fold. First, the bird is not able to bill the mash out of the hopper. In other words, the wastage of feed is largely reduced. The second reason is increased utilization of the mash. The bird no longer is able to confine its diet to those bits of feed which it prefers. The fowl is forced to take the mash as it comes, thereby getting the beneficial parts which are ordinarily avoided.

The reduction in bird nervousness is an advantage worth mentioning. Birds flying against fences, or throwing a fit in cages whenever a change in surroundings occurs, is not a healthy nor a desirable condition. It is remarkable how nervousness is reduced and, in some cases, completely eliminated by debeaking. Evidently bird nervousness is based on the fear of picking or fighting. Debeaked birds can not pick or fight, and the removal of the fear of this constant threat causes each bird to feel secure in its surroundings.

Uniform bird quality has been mentioned as an advantage of debeaking. The reason for this result is undoubtedly due to giving birds a more equal chance at the feeders. Bullies can not hog the feed, and timid birds are given a fair chance to get their share of food. The elimination of feather pulling and bare backs is a factor in uniform bird quality also. The presence of bare backs in a flock proves the existence of picking, although cannibalism has not yet developed. Also, a bird with a crop partially filled with feathers does not have the same chance for growth as does the bird whose entire crop capacity is utilized for food.

Article prepared especially for AGRICULTURAL ENGINEERING.
JIM LYON is manager, Lyon Rural Electric Company.

As a cure for egg-eating hens, debeaking is a remedy which is simple, quick, and in most cases permanent because the hen loses the habit. After being debeaked attempts of the hen to break the egg are unsuccessful.

The foregoing paragraphs deal with the results of debeaking as far as management of the flock is concerned. The operation of debeaking (with suitable equipment) is easy and in itself has certain advantages. From 150 to 400 birds per hour can be debeaked with well-designed equipment, and anyone with a little practice can do the job.

Debeaking is also harmless. Correctly debeaked birds are eating soon after treatment. I have seen birds start eating within a minute. The secret of proper debeaking is to shorten the beak not too fast to cause bleeding nor too slow to cause cooking of the bill. The latter is unusual but, unless avoided, will prevent the bird from eating for a day or two. A correctly debeaked bird quickly learns to eat grain and grit, as well as mash, and feeders will be cleaned. The bird handles shells and green leaves with a little difficulty, and it is best to break or chop these materials at the start.

Debeaking is simple. Only the upper bill is shortened; the lower beak and tongue are left intact. Correctly designed apparatus has a water-cooled beak support so that the tongue of the bird will not be burned while the upper beak is being cauterized. Attention to such details as this may help to account for the fact that layers can be debeaked without causing a decrease in egg production. The amount to debeak depends to some extent on how long the birds are to be kept. It the beak is burned too close to the tip, regrowth will be much faster than otherwise. The usual practice is to shorten the beak to a point half way between the tip and the nostrils. For safe and fast operation, an adjustable guide should be provided on the debeaker.

DEBEAKING MAY CURE PICKING HABIT

Debeaking is convenient. The time for debeaking is largely a matter of convenience. Debeaking birds younger than four weeks of age can be done but is not advisable. It puts the second debeaking operation a little closer, and picking before four weeks of age is seldom serious. Most birds are debeaked as they are removed from the brooder. A debeaking operation will generally last for three months or more. Some poultrymen have debeaked their birds so close to the nostrils that no regrowth has occurred. This practice is not recommended for beginners in debeaking. Sometimes no more debeaking is required because the birds have lost their habit of picking and their new bills appear somewhat tender.

Debeaking is sanitary. Debeaked birds stay more clean. Shields and similar devices with their problems of labor, cleanliness, or lice are unnecessary.

Debeaking is inexpensive. The average cost of helmets or pick guards is 2½c each. To protect 2000 birds costs $50.00 plus a fair amount of work. These 2000 birds could be debeaked in a fraction of the time with a commercial debeaker costing only $14.50. In this particular case, there is a cash saving of $35.50 in equipment plus a labor saving plus additional advantages of less nervousness, less feed wastage, etc. Moreover, the debeaker will treat many many more birds. The total cost per bird is a fraction of a cent.

Debeaking can be accomplished with anything from a fine-pointed gas torch flame — or a high wattage soldering iron — to a complete machine designed especially for the purpose. The blow torch, of course, requires an expert to use it, and it is not necessarily foolproof. The soldering iron is difficult to obtain these days, and it should have a wattage of 500 watts for satisfactory operation in spite of wind or voltage drop. An iron of this size costs $15.00, when it can be purchased. Of course, it is advisable to mount the soldering iron in a frame and to provide for a beak support, leverage, etc. As far as I know, there is only one commercial debeaking machine on the market. It has all the advantages of safe operation, water-cooled beak support, adjustable guide, ample heat with only 250 watts, high speed and long life.


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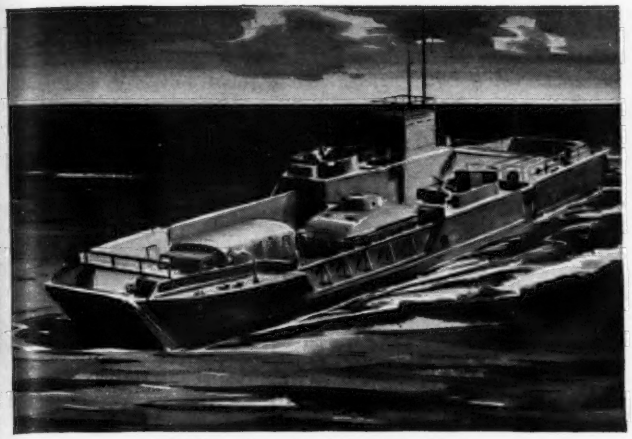
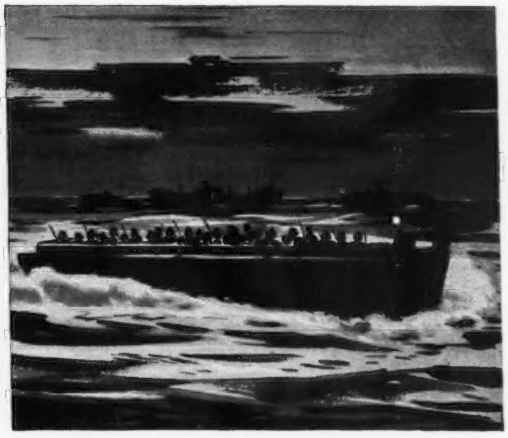


LCT (Landing Craft Tanks) 105 ft.



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Agricultural Engineering Digest

A review of current literature by R. W. TRULLINGER, assistant chief, Office of Experiment Stations, U. S. Department of Agriculture. Copies of publications reviewed may be procured only from the publishers at the address indicated.

COTTON GINNING FOR PURE SEED PRESERVATION, *C. A. Bennett* and *F. L. Gerdes*. U. S. Dept. of Agr. (Washington) Leaflet 217 (1942). This leaflet points out the means by which the mixing of seed of different varieties of cotton can be prevented during the ginning processes and also the precautions which must be taken at any gin to make it suitable for the preservation of seed purity. Methods considered practical consist in the use of (1) self-cleaning belts, (2) self-cleaning blowpipe systems, and (3) gravity chutes in two-story gins and combinations of (1) and (2). Systems now in use for putting these methods into practice comprise the following: (1) A horizontal flat seed belt in a smooth trough below the stands, delivering either to an inclined belt or to a seed-blowing pipe through a vacuum wheel seed feeder. (2) A reversible horizontal flat seed belt beneath the stands, operating in one direction to deliver gin-run seed and in the other to deliver pure seed, each discharging into disposal apparatus by various means. (3) Two individual conveyors beneath the stands, gin-run seed being handled in the front system and pure seed in the rear one, or vice versa, each screw system having its own lifts and deliveries. The pure seed system of course is completely accessible for cleaning between runs. (4) In two-story gins gravity chutes with hinged covers in front of or below each gin stand, diverting pure seed by gravity into funnels, sacks, or belts below. A standard screw conveyor is generally used on gin-run seed. (5) Gravity chutes similar to those described above, short enough for single or two-story gins, delivering pure seed from each gin stand into a blowpipe by means of individual rotating vacuum-wheel seed feeders.

It is pointed out that when elevation of cotton seed is necessary, only the blowpipe or inclined-belt systems can be regarded as self-cleaning. Vertical screw and bucket type elevators cannot be depended upon to be fully self-cleaning even when seed from several bales have been run through the system in an effort to clean it before commencing to save planting seed.

KEEPING YOUR HOUSE IN REPAIR, *A. F. Collins*. D. Appleton-Century Co. (New York) 1941. The purpose and scope of this book are adequately indicated in the title and in the author's statement that this book was written "for the man of moderate means who owns his house and who would rather keep it in repair himself than to suffer the slings and arrows that are his lot when he hires the average mechanic to do the job for him." Practical directions for selecting the most suitable tools and materials and for making both minor and major repairs and renovations are given, the following being the specific subjects covered: Making carpentry repairs, making roof repairs, masonry and plastering repairs, making stucco and concrete repairs, painting the outside of your house, finishing the inside of your house, papering the rooms of your house, making glazing repairs, repairing the plumbing system, repairing your heating plant, repairing the electric installation, and repairing builder's hardware. Chemical formulas having almost no relation to the actual chemical composition of the compounds named appear on pp. 115 and 128.

"GASCOIGNE" AUTORELEASER MILKING PLANT, *E. H. Lamb* and *F. H. Jordan*. (Gt. Brit.) Min. Agr. and Fisheries, Agr. Mach. Testing Com. Certif. and Rpt. 73 (1942). This report covers the performance of a complete set-up of milking equipment of four stalls and a building provided for the tests. The trial was continued through 15 mo with generally very satisfactory results. The special feature of the equipment, the "autoreleaser", consisted essentially of a metal cylinder counterpoised, when empty, in the horizontal position, but tipping to a position about 30 deg from the horizontal after filling with milk. The tipping operated means for shutting off the flow of milk and the vacuum lines from the cylinder and for opening a large diaphragm valve at the lowered end of the tipped cylinder so that its contents were emptied into a receiving vat. The counterpoise then returned the cylinder to the horizontal position completing the cycle of movements by reopening the milk flow and vacuum line.

The over-all report is that the layout of the plant is compact, laborsaving, convenient, and gives reasonable comfort for the cows. Under the conditions of the test the Gascoigne autoreleaser milking plant gave generally satisfactory results. The general mechanical efficiency of the plant was good. *(Continued on page 102)*

Agricultural Engineering Digest

(Continued from page 100)

WEED CONTROL IN GROWING CORN, *C. K. Shedd, E. V. Collins, J. B. Davidson.* Iowa Ag. Exp. Sta. (Ames) Bul. P44. General methods of combating weeds are outlined. Improved equipment which enables the careful farmer to improve the control of weeds in cornfields is described, as are methods of seedbed preparation which assist in control of weeds without excessive input of labor or power. The principal purpose of cultivation of corn is to control weeds, but early cultivation to control sand-blowing is also essential under some conditions.

For early cultivation of corn, the spring tooth weeder and the rotary hoe were effective in killing weed seedlings when the soil surface was lightly crusted by moderate rainfall, but they were not very effective when the soil was heavily crusted by intense rainfall nor when the soil surface was loose and dry. The best cultivator equipment for use when corn plants were small consisted of six sweeps per row and rotary hoe shields. When first cultivation could be delayed until corn plants had grown about six leaves, it was found best to leave off the shields and use half sweeps next to the corn row. The best equipment for second cultivation under usual conditions was one pair of disk hillers throwing soil into the corn row and two pairs of sweeps per row. Experimental scrapers on the disk hillers prevented coverage of corn plants. For the last cultivation the best equipment was the same as for the second cultivation, except that scrapers on the disks were not needed. An experimental spring tooth weeder rear attachment for a tractor cultivator was effective in filling tractor wheel tracks, leveling the soil between corn rows and improving weed control. Speed of travel of cultivators to do the best job of destroying weeds was generally between 2.5 and 4 mph.

Three cultivating programs are suggested for check-rowed corn with a view of improving weed control and keeping labor and power input at a minimum.

THE UTAH SNOWMOBILE: A MACHINE THAT PROVIDES POWER TRANSPORTATION OVER SNOW-COVERED AREAS AND MAY BE OF USE TO THE ARMY FOR SUCH PURPOSES, *G. D. Clyde.* Farm and Home. Sci. Utah. Ag. Exp. Sta. (Logan) 3 (1942). This device is provided with a split endless track running over six rubber tires, the middle set of wheels being somewhat lower than the other two pairs so that the machine tended to pivot on the middle pair. Steering was accomplished by means of a small runner outrigged in front of the machine and operated by the steering wheel in the cab. In snow survey work the machine carried 11 men and their equipment weighing about 1,500 lb a round trip of about 12 miles in about 3 hr driving time over a course at elevation 8,250 ft and grade which in some instances, reaches 25 per cent. The snow was soft in the timber and crusted in the open.

The total area of the tracks is approximately 32 sq ft and the maximum weight of the equipment with its load, exclusive of that carried as the guiding runners, is about 2,000 lb. This equipment can therefore be operated on very light snow as the weight is less than 0.5 lb per sq ft. In very loose soft snow the tracks settled as much as 20 in, but no stalling of the motor occurred. The sled was powered by a 65-hp Chevrolet motor and a 1.5-ton rear end. The transmission was geared for a compound low speed, which gave ample power under the most adverse conditions. It is believed that this type of equipment will solve the problem of power transportation over snow-covered areas and should be of great interest to the Army as well as irrigation, power, and municipal water users.

EROSION ON VERMONT PERMANENT PASTURES, *A. R. Midgley, C. V. Plath, and J. J. Mayernik.* (Coop. USDA) Vermont Ag. Exp. Sta. (Burlington) Bul. 483 (1942). Sheet erosion is not a major factor on Vermont permanent pastures. It is not appreciable even on very steep slopes, provided the vegetation has not been so damaged as to lead to active gullying. On the lighter soil types even a spare moss and weed cover serves to check the water runoff. The largest water losses occur when accumulated snows thaw. Gullies form somewhat readily on the lighter soil types at points where the turf breaks, because of overgrazing or from other causes, where the vegetative cover is poor. Contour furrows seem to be of little avail with light soil types but may be of some service on the more retentive soils.

These conclusions were drawn from detailed observations throughout the State, from erosion investigation plats on Hartland silt loam of 16 per cent slope and on Hartland sandy loam of 27 per cent slope, and from runoff and soil loss measurements on Hartland silt loam pasture land of 47 per cent slope, as well as on the Woodbridge, Adams, and other soils at lower and higher slope percentages. Very little erosion occurred on pasture lands even of 50 per cent or greater slope, except these steep slopes were too heavily grazed. Stream-bank erosion seemed the most serious form of soil loss in Vermont, and much work has already been done to check such bank cutting. *(Continued on page 110)*

NEWS SECTION

A.S.A.E. Meetings Calendar

March 10 and 11 — Southwest Section, Baker Hotel, Dallas, Tex.

June 19 to 21 — Annual Meeting, Hotel Schroeder, Milwaukee, Wis.

December 11 to 13 — Fall Meeting, Stevens Hotel, Chicago.

Washington Section Has Luncheon Meeting

THE Washington (D. C.) Section of the American Society of Agricultural Engineers held a luncheon meeting in the South Building of the U. S. Department of Agriculture on Friday, February 11.

The program of the meeting featured a talk by J. A. Krug, program vice-chairman of WPB and chairman of the Requirements Committee, on problems connected with dividing available materials between claimant federal agencies, and another talk by J. W. Millard, director of the office of materials and facilities, WFA, on securing materials for food and fiber production.

Following these talks there was a short discussion of programs for future meetings.

Current officers of the Section are George Krieger, chairman; C. L. Hamilton, vice-chairman; and N. R. Bear, secretary.

Chicago Ag Engineers Meet

THE Chicago group of members of the American Society of Agricultural Engineers held a meeting at the Top-of-the-Town Restaurant, Lake and Wabash, Chicago, on Monday evening, February 14. The speaker of the evening was Major Olaf Stokstad of the Corps of Engineers, U. S. Army, who is in charge of air field construction. His talk dealt with the soils problems involved in this work.

The next meeting of the group will be held on Monday evening, April 10, at the same place, and all members of the Society who live in the vicinity or who expect to be in Chicago at the time are cordially invited to attend. An interesting program is promised.

War Department Needs Foreign Maps

THE U. S. War Department is searching for foreign maps of *all* areas outside continental America, to be used by the Army Map Service in Washington. It needs city and port plans on a scale of not less than 1:25,000; road maps and topographical and geological maps not smaller than 1:1,000,000; important foreign atlases; guide books, place-lexicons, gazeteers and postal guides. It does *not* need maps printed in the United States or Great Britain, such as the National Geographical Society, etc., and World War I maps. The more recently issued publications are preferred.

In sending such material, it is important to state whether or not it is a gift to the War Department. If it is being loaned to the Department, reproduction will be made and the originals returned to the senders.

All material should be forwarded to the nearest area office, as follows: Chicago Library Branch, Army Map Service, 79 W. Monroe St., Chicago 3, Ill.; New York Library Branch, Army Map Service, 1270 Sixth Ave., New York 20, N. Y.; San Francisco Library Branch, Army Map Service, 74 New Montgomery St., San Francisco 5, Calif.

Personals of A.S.A.E. Members

Albert W. Lavers was recently appointed industrial tractor engineer for Harry Ferguson, Inc. In accepting this appointment Mr. Lavers severed an association of several years as chief engineer of the tractor division of the Minneapolis-Moline Power Implement Co. Among Mr. Lavers' outstanding contributions to tractor engineering was the designing and building of the first internal-combustion, spark-ignition tractor engine to operate on 70-octane gasoline. Mr. Lavers was chairman of the A.S.A.E. Power and Machinery Division in 1934-35, and during the same year also served as second vice-president of the Society.

(News continued on page 106)

NEWS SECTION

(Continued from page 104)

Albert L. Burkett recently resigned as superintendent of the Carrizo Springs (Tex.) Grape Project, to accept appointment as agricultural engineer at the agricultural experiment station at Tingo Maria, Peru. This station is cooperative between the United States and Peru through contractual arrangement, and it will be used principally in the development and production of crops which are non-competitive with those of this country. The agricultural engineering phases of the work will involve construction, drainage development, and the adaptation of farm machinery to special needs in the area.

Alvin C. Dale, who joined the U. S. Engineers Corps in 1941 as a junior engineer, was recently commissioned a second lieutenant in the Army Air Forces and has been assigned as a weather officer at Berry Field in Tennessee.

C. T. Rasmussen has recently resigned as chief engineer, experimental department, John Deere Wagon Works, to accept an engineering position in the Bean-Cutler Division, Food Machinery Corp., San Jose, Calif.

Harry E. Reddick recently resigned as regional conservator (Region 10) of the U. S. Soil Conservation Service to go into the business of farming. From now on it will be "Sunkist Harry," specializing in lemons and oranges. He is a former chairman of the A.S.A.E. Pacific Coast Section.

Glenn E. Saha recently resigned an engineering position with the Glenn L. Martin Company in Baltimore to take over the management and operation of a family 260-acre corn and hog farm in Iowa.

Applicants for Membership

The following is a list of recent applicants for membership in the American Society of Agricultural Engineers. Members of the Society are urged to send information relative to applicants for consideration of the Council prior to election.

M. H. Allen, regional director-engineer, Structural Clay Products Institute, 120½ Welch Ave., Ames, Iowa.

Charles C. Fisk, 2nd Lt., AAF, USA. Assistant station weather officer, Base Weather Station, Stout Field, Indianapolis 6, Ind.

Edwin Freyburger, chief, regional engineering division (Region 5) Soil Conservation Service, USDA. (Mail) 2735 N. Hackett Ave., Milwaukee, Wis.

Ebenhard S. Gandrud, owner and manager, E. S. Gandrud Company, Owatanna, Minn.

Jesse E. Harmond, agricultural engineer,Bureau of Plant Industry, Soils and Agricultural Engineering, USDA. (Mail) 8812 Edmonston Rd., Berwyn, Md.

Alfred M. Pendleton, extension cotton ginning specialist, Extension Service, USDA. (Mail) 4352 Edmondson St., Dallas, Tex.

Carroll P. Streeter, managing editor, Farm Journal, Washington Square, Philadelphia 5, Pa.

J. Phelps Walker, department of agricultural engineering, Verginia Polytechnic Institute. (Mail) R. R. No. 4, Bedford, Va.

T. Harold Welch, associate construction engineer, Farm Security Administration, USDA. (Mail) P.O. Box 1676, Billings, Mont.

Fred Yenny, regional service manager, Herry Ferguson, Inc. (Mail) Box 25, Onondaga, N. Y.

TRANSFER OF GRADE

Roy D. Crist, Maj., Tng. Gp. Hq., L.A.A.F. USA. Laredo, Texas. (Junior Member to Member)

D. B. Lancaster, manager, Bowie Cass Electric Cooperative, Inc., Douglassville, Tex. (Junior Member to Member)

D. H. Malcom, manager, agricultural markets dept., American Rolling Mill Co., Middletown, Ohio. (Junior Member to Member)

L. John Schilling, president and manager, Schilling Electric Co., Box M, Galesville, Wis. (Junior Member to Member)

A big tanker like this can carry about 6,300,000 gallons of aviation gasoline. That gallonage of automobile gasoline would be enough normally to supply all the motorists in a city the size of St. Louis for three weeks. And this is but one ship out of the vast fleet now supplying United Nations' fighting forces.

6,300,000 Gallons of Air Raid

... on its way to Berlin

▸ It's easy to see why there's less gasoline in the U.S.A. for civilians.

Also why there's less Ethyl fluid available for your gasoline.

For every gallon of fighting grade aviation gasoline contains a generous portion of Ethyl antiknock fluid. Today, not only is more Ethyl fluid needed for more aviation fuel, but more of it is going into each gallon.

What happens after the war—when most of this high octane gasoline can stay home? You'll have gasoline for *your* automobiles, trucks, buses and farm tractors of higher quality than ever before. And when engines are designed to take full advantage of high-octane fuels, you'll get more work, more power, more economy out of every gallon.

In this post-war development, through its laboratories in Detroit and San Bernardino, the Ethyl Corporation is prepared to play a special part. Though we are not directly engaged in the manufacture of fuels, engines or engine parts, we belong to both the oil and automotive industries. Thus we will be able to cooperate with both groups; to help them unite their individual efforts toward the ultimate peacetime goal of making future transportation better and cheaper.

* * *

ETHYL CORPORATION

Manufacturer of Ethyl fluid, used by oil companies to improve the antiknock quality of aviation and motor gasoline

CHRYSLER BUILDING, NEW YORK CITY

Congratulations

ON A FINE JOB, WELL DONE!

THE Treasury "Star" Flag—the bond-buying counterpart of the Army-Navy "E"—marks plants with at least 90% of personnel participating in the Payroll Savings Plan to at least 10% of gross payroll, *and also having reached, or topped, a War Loan Drive quota!*

The successful close of the 4th War Loan Drive finds many more "Star" Flags than ever before flying over the industrial plants of America. To all these, go the heartiest thanks of the nation, and the deep appreciation of the Treasury Department for a great job! And to those who may not quite have qualified for the "Star," go equally sincere thanks—and the confidence that soon they, too, will join the ranks of the "Star" fliers.

One thought that many concerns have found helpful in stepping up the intake from their Payroll Savings Plans is this. In many cases the Treasury Representative in a plant has been able to point out the fact that during *Loan Drive periods* the employees have found it possible to spare much more than they had counted on when setting up their original subscription, and that—*when properly approached*—a very substantial fraction of such employees will decide they can well afford a distinct increase in their current Payroll Savings Plan.

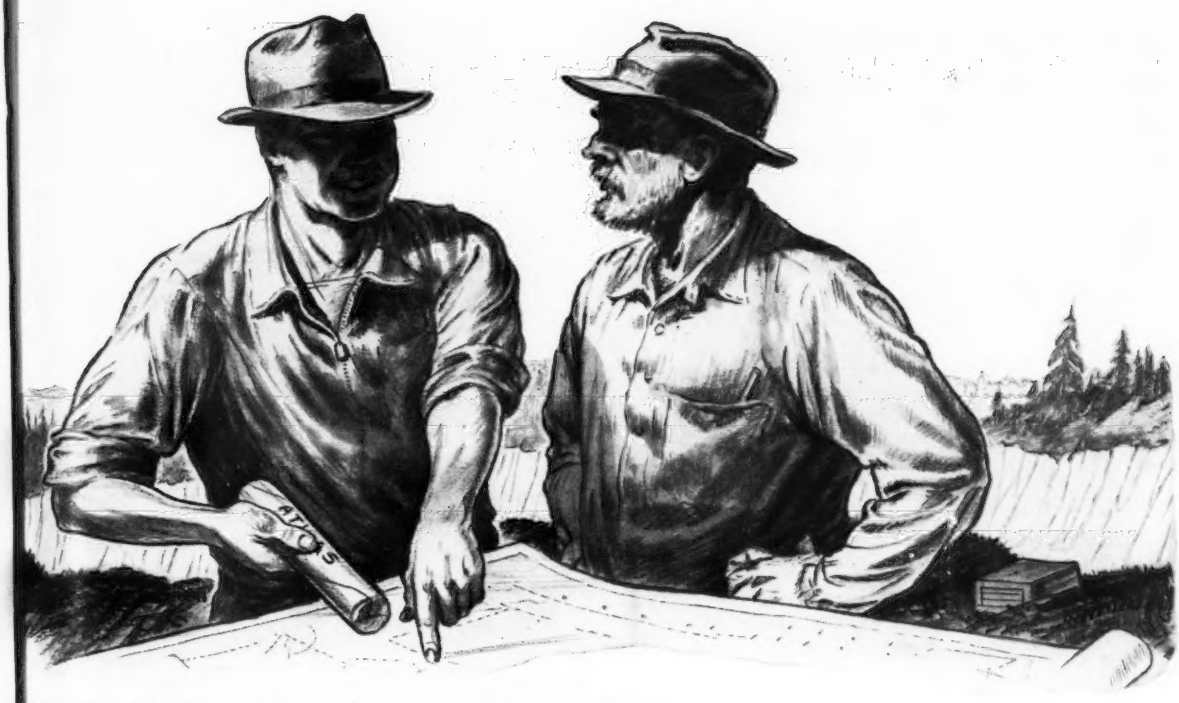
Talk this over with your Treasury Representative—it offers important possibilities when correctly handled. And again accept the Treasury Department's congratulations for your fine work in helping to put over the 4th War Loan.

LET'S **ALL** KEEP
BACKING THE ATTACK
WITH **WAR BONDS**

The Treasury Department acknowledges with appreciation the publication of this message by

AGRICULTURAL ENGINEERING

This is an official U. S. Treasury advertisement—prepared under auspices of Treasury Department and War Advertising Council.



Old "Forty Per Cent" Has Been a Good Handyman . . .

But . .

For years, many a blaster has depended on "Old Forty Per Cent" dynamite for the job, regardless of conditions involved—with the old reliable handy, no need to monkey with new-fangled dynamite. "Old Forty Per Cent" has turned in a reasonably satisfactory performance, too.

But like all handymen, "Old Forty Per Cent" does not always measure up to the job. Special conditions call for special qualities that the old handyman dynamite does not possess. The blaster needs the right explosive and the right method to do the job right.

After all, explosives are tools of production. As in any precision operation, the right tool must be used in the right way to achieve the best results. Blasters are learning that blind dependence on "Old Forty Per Cent" is not necessarily the way either to get the best blasting result or the lowest costs of operation.

To insure the right explosive for the job, Atlas provides more than one-hundred and twenty grades and types of explosives in over 300 sizes to choose from. And Atlas representatives always are ready to apply synergistic* thinking to your blasting problems to produce better results at lower costs. Consult us.

***Synergism**—*a growing habit in American industry. Men bring problems and ideas together so that minds "click" to produce a result far greater than the sum of ideas expressed. So to speak, they make 2 plus 2 equal 5.*

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PROFESSIONAL DIRECTORY

RATES: Announcements under the heading "Professional Directory" in AGRICULTURAL ENGINEERING will be inserted at the flat rate of $1.00 per line per issue; 50 cents per line to A.S.A.E. members. Minimum charge, four-line basis. Uniform style setup. Copy must be received by first of month of publication.

Agricultural Engineering Digest *(Continued)*

REDUCTION OF IRRIGATION WATER LOSSES, *O. W. Israelsen.* Farm and Home Sci., Utah Ag. Exp. Sta. (Logan) 3 (1942). Of conveyance losses, seepage is the greatest and probably cannot be entirely prevented. The points of greatest seepage can be located, however, and ditches lined with clay or the like at these points. Transpiration losses through vegetation along the canal bank and vegetative or other obstructions in the canals can be dealt with more promptly. Irrigating on the basis of examination of the soil to ascertain actual need rather than on that of the "watering turn," which wastes such water as is applied when the soil is already wet, could save much water. The best irrigation practices are considered seldom to store in the soil root zone more than 75 per cent of the water delivered to the farm. The major cause of low water-application efficiencies is the application of excessive depths of water in single irrigations. A depth of 6 in is usually quite enough, and on shallow soils it is too much. Careful control of the size of stream, avoiding excessively long runs, frequent transfer of water from one plat to another, careful inspection of depth of water penetration, use of run-off of high land to irrigate lower lands, or better still, prevention of run-off completely are some of the means by which irrigators can increase water-application efficiencies. Other important measures are to avoid runs of 660 ft or longer, to apply the water at a rate greater than the rate of infiltration into the soil, to avoid land slopes of 3 per cent and higher in the direction of the flow of the irrigation stream, not to let the water concentrate into large streams on parts of the farm and thereby cause erosion and gullying, to measure the stream or get the water master to measure it, and to keep records of the depth of water applied.

EMPLOYMENT BULLETIN

The American Society of Agricultural Engineers conducts an employment service especially for the benefit of its members. Only Society members in good standing may insert notices under "Positions Wanted," or apply for positions under "Positions Open." Both non-members and members seeking to fill positions, for which ASAE members are qualified, are privileged to insert notices under "Positions Open," and to be referred to members listed under "Positions Wanted." Any notice in this bulletin will be inserted once and will thereafter be discontinued, unless additional insertions are requested. There is no charge for notices published in this bulletin. Requests for insertions should be addressed to ASAE, St. Joseph, Michigan.

POSITIONS OPEN

REGIONAL SERVICE MANAGER seeking postwar security is wanted by well-known, fast-growing manufacturer of farm tractors and implements who is expanding his organization to prepare for postwar opportunity. Man needed to contact distributors to see that factory service policies are inaugurated and followed through. Must be able to command respect; must know farm implements, their use, care and maintenance and be able to pass his knowledge on to others through meetings, training and supervision. Probably college trained with practical experience; married, and between the ages of 30 and 45. Salary open. Write in confidence to Director, Council for Market Development, 1404 Maccabees Bldg., Detroit, Mich.

AGRICULTURAL ENGINEER wanted. The National Safety Council is seeking a qualified agricultural engineer for the staff of its Farm Division. The duties will be to promote and carry out programs in farm and farm home safety. If interested, write National Safety Council, 20 North Wacker Drive, Chicago 6, Ill.

FARM EQUIPMENT ENGINEERS. National merchandising organization planning large farm equipment program has openings for senior and junior design engineers. Write experience, draft status, salary expected. Replies confidential. PO-155

(Continued on page 112)

EMPLOYMENT BULLETIN

(Continued from page 110)

DRAFTSMAN. Experienced man for real critical war work. We also have fine opportunity from postwar standpoint. If you have had plan layout, piping, machine design, architectural or any mechanical drawing background, write us at once. State experience and salary desired. PO-154

ENGINEER interested in drainage research wanted. Southern state with large acreage needing drainage plans to begin intensive research program. First letter should give training, experience and references. PO-153

RURAL ELECTRIFICATION SPECIALIST wanted by agricultural college for combination research and extension work. A very progressive southern state with outstanding rural electrification program. Salary commensurate with training, experience and ability. PO-152

CHEMICAL, MECHANICAL OR DEVELOPMENT ENGINEERS. Major industrial company is setting up staff to handle postwar operations. Interested in several experienced men, college-trained, for our development, engineering and manufacturing divisions. Our interest is in men capable of supervising and carrying forward important technical work of a very broad nature. In reply cover carefully experience, education, draft status and salary expected. PO-151

AGRICULTURAL ENGINEERING opening in northeastern university. At present the activities will be largely in the extension service with some time devoted to development work in farm equipment and work simplification. Man with general interest or experience in agricultural engineering preferred. Full statement of training, experience, draft status and other information should be given in first letter. PO-150

AGRICULTURAL ENGINEER wanted on a 15,000-acre vegetable farm in southern New Jersey. The position will be that of assistant to the farm superintendent and will include the work of directing the maintaining and repairing of farm buildings and operating equipment. Applicants should have an engineering education as well as considerable practical experience with farm operating equipment and buildings. In addition to repair work, the job will include responsibility for occasional new building construction which will call for actual construction experience and ability to lay out and design farm structures as well as supervise their construction. The farm equipment includes 300 dwellings with all the barns and sheds that go with them, 40 Caterpillar Diesel tractors 60 Farmall tractors, and all the necessary miscellaneous farm equipment, together with a large fleet of trucks. The position can be enlarged or contracted to suit individual abilities. Salary $3000 to $4800 depending upon individual qualifications. PO-149

ENGINEERS WANTED in our plants in CALIFORNIA, FLORIDA, ILLINOIS and other states. Must have had at least three years' experience in general machine design. Our work is postwar development of machines for use in agriculture and in fruit and vegetable canneries, packing houses, and processing plants. Please give full history, including family, also name of state in which you prefer working, and salary expected — also snapshot of yourself if available. Reply to Food Machinery Corp., San Jose, California.

AD COPY WRITER wanted. Man with some technical experience who is creative and has the knack of writing simple, forceful copy for industrial and technical advertising is desired. Permanent position and good opportunity for advancement with long-established 4-A advertising agency. Correspondence will be kept confidential. PO-146

POSITIONS WANTED

AGRICULTURAL ENGINEER with B.S. and M.S. degrees in agricultural engineering and economics, with experience in resident teaching, extension, and research work at two eastern universities, 29 years of age, farm reared, in good health, and whose draft status is 3-D, would be interested in a position teaching agricultural engineering with an opportunity to do research work at some university, or would consider a position with a farm machinery or public utilities company. PW-358

AGRICULTURAL ENGINEER with B. S. in both agriculture and mechanical engineering from midwestern university. Some graduate work in engineering. Desires position in college teaching, research, or extension, or with private concern. Has had experience in soil conservation, farm machinery and equipment, farm structures, and rural electrification. At present employed as a state extension agricultural engineer. Farm reared. Married. Age 38. Good reason for desiring a change of position. References and professional record available upon request. PW-357